Supplemental Environmental Assessment

for

Grazing Outlease at Fort Hood, Texas

DRAFT

February 2003

Supplemental Environmental Assessment for a Grazing Outlease Program at Fort Hood, Texas

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

DRAFT
FINDING OF NO SIGNIFICANT IMPACTS (FONSI)
FORT HOOD LIVESTOCK GRAZING OUTLEASE PROGRAM

1.0 NAME OF ACTION

Proposed grazing outlease for portions of the Fort Hood military reservation.

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

In accordance with Army Regulations, resource managers at Fort Hood have determined that excess forage is available in portions of the installation that would be available for use by livestock without impacting the training mission or natural resources. Therefore, the Department of the Army intends to make those resources available for livestock grazing through the Army's agricultural outlease program.

Resource Managers have selected a grazing alternative (Alternative 5, Preferred Alternative in the *Supplemental Environmental Assessment* [SEA]) to be the proposed alternative for this SEA. Under this proposed alternative, stocking rates are calculated for each Grazing Management Unit based on the best management strategies and forage residue goals for each unit, the amount and type of available forage determined from annual inventories, other land uses for the unit, potential for impacts to soil erosion, and potential for direct conflicts with training activities. Under this alternative, the Army would consider deferring grazing in any of the units if the predicted soil erosion rates based on the Revised Universal Soil Loss Equation (RUSLE) model exceed the acceptable levels for the unit, or if Ecological Health Indices show that the ranges are in poor or declining condition.

Areas with minimal training activities – (West Fort Hood, North Fort Hood) The Standard 25% Harvest Efficiency approach for determining stocking rates would be used, which sets as a goal to leave as residue half of the consumable forage that is present on the site, with deferment of grazing in years when grazing may result in severe erosion.

Areas with moderate training activities – (Eastern Training Areas) A Maintenance Threshold approach is used to calculate stocking rates, in which a moderate volume of forage must be left in the area after grazing as residue to maintain the current condition of the land, with grazing deferment in areas where insufficient forage exists to achieve the residue threshold.

Areas with substantial training activities – (Western Maneuver Areas) A Conservation Threshold approach is used to calculate stocking rates, where greater volumes of forage are left in the area after grazing as residue to enhance recovery of the vegetative community and reduce erosion, with grazing deferment in areas where insufficient forage exists to achieve the threshold.

2.2 OTHER GRAZING ALTERNATIVES CONSIDERED

Three other grazing alternatives were considered. In these alternatives, each of the three approaches to stocking rate calculations described above are applied to all Grazing Management Units without deferral of grazing, and regardless of training activities or ecological condition (Alternatives 2, 3, and 4 in the SEA).

2.3 NO GRAZING ALTERNATIVE

The final alternative evaluated in the SEA was a No Grazing Alternative (Alternative 1 in the SEA). Under this alternative, grazing would not be allowed on the installation, regardless of forage availability.

3.0 SUMMARY OF ENVIRONMENTAL EFFECTS

Fort Hood is located in central Texas in Bell and Coryell counties, 58 miles north of Austin. The installation encompasses about 87,940-hectares (ha) (217,300 acres), of which only 80,332 ha (198,500 acres) are available for potential grazing, and much of that is covered in ashe juniper and hardwood trees or shrubs preventing substantial growth of grasses and other low-growing plants. Many of these forested areas are habitat for two bird species, the Golden-Cheeked Warbler and the Black Capped Vireo, protected under the *Endangered Species Act*.

Fort Hood was purchased from the landowners over a period of time, and those landowners have been allowed to graze these lands since then through outlease programs directly through the owners, and later through the Central Texas Cattlemen's Association (CTCA). Military training activities on the installation include full-scale battle scenarios using tracked- and wheeled-vehicles, infantry, live-fire munitions, and aerial support. In some areas, training activities are limited to foot-traffic, minimizing the impacts of the training on the soil and vegetation.

Numerous studies and monitoring data have shown that the ecological condition of the installation has declined in the past decades, namely in the form of reduced herbaceous vegetative cover and severe erosion in a number of areas. Military training with tracked- and wheeled-vehicles, extended drought, continuous grazing with no deferments, and a lack of integrated grazing management have been identified as the primary contributors to the ecological decline of the area.

In 2000, the Army generated an *Environmental Assessment* (EA) of the proposed renewal of the lease. In that EA, the Army determined that grazing could occur on the installation but only at a significantly reduced stocking rate and with deferral of grazing in portions of the installation for vegetative recovery and protection of endangered species. Due to the complexity of some of the alternatives considered and the lack of continuity of the forage availability data, the Army agreed to revisit the alternatives and use forage inventory data produced by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) specifically for this project.

The SEA evaluated the potential impacts of the proposed action, the no grazing alternative, and the three grazing alternatives on land use, visual resources, biological resources, soil and geology, socioeconomics, cultural resources, water, noise, air quality, utilities, and transportation. Potentially significant adverse impacts on soil resources, water quality, and vegetation were predicted for the three grazing alternatives, primarily due to the contribution of the grazing impacts on soil erosion, and the resulting impacts of that erosion on other resources. Though soil erosion would continue to occur in many areas under the proposed action and the no grazing alternative, the substantially reduced grazing or deferment of grazing would not have a significant negative impact on the resources.

4.0 CONCLUSION

Based on the information and analyses presented in this *Supplemental Environmental Assessment*, the Proposed Action would not likely have significant adverse impacts on the quality or the integrity of the

human or natural environments. Therefore, an *Environmental Impact Statement* (EIS) will not be prepared for the Fort Hood Grazing Outlease Program.

SIGNED:_____ DATE:_____

WILLIAM H. PARRY III
Colonel, AR
Garrison Commander

EXECUTIVE SUMMARY

The proposed action being addressed in this document is generation of a new lease agreement for the grazing program at Fort Hood. In 2000, the Army generated an *Environmental Assessment* (EA) of the proposed renewal of the lease. In that EA, the Army determined that grazing could occur on the installation but only at a significantly reduced stocking rate and with deferral of grazing in portions of the installation for vegetative recovery and protection of endangered species. Numerous comments were received claiming the grazing management strategies were too restrictive and too complicated to implement. Other comments asserted that the stocking rate calculations were based on outdated and incomplete forage availability data. The Army agreed to consider new alternatives in a *Supplemental Environmental Assessment* (SEA), given that the U.S. Department of Agriculture (USDA) agreed to have the Natural Resources Conservation Service (NRCS) conduct a site-wide forage inventory in May 2002.

Background

The land that makes up Fort Hood was purchased from the original landowners over a period of time, and those landowners have been allowed to graze these lands since then through outlease programs directly through the owners, and later through the Central Texas Cattlemen's Association (CTCA).

Military training activities on the installation include full-scale battle scenarios using tracked- and wheeled-vehicles, infantry, live-fire munitions, and aerial support.

The scope of this SEA is the evaluation of the potential environmental impacts of a proposed outlease grazing program on the Fort Hood Military Reservation. The contractual and procurement related issues, the costs of the proposed action to the Army and Fort Hood are not evaluated as part of this document. Likewise, the impacts of military training are not evaluated in this SEA.

Fort Hood has developed an Integrated Natural Resources Management Plan (INRMP) for the installation. The U.S. Fish and Wildlife Service (USFWS) and the Texas Parks and Wildlife Department (TPWD) are identified as signatory agencies on the INRMP, and numerous other agencies and organizations were identified as partners in development and implementation of the document. Though the INRMP has been developed, the document has not been signed by the TPWD or the USFWS. Because of this, the INRMP currently is not considered final, however, the Army is implementing many of the management actions identified in the document within the annual budgetary allocations provided.

Alternatives

This SEA evaluates the potential impacts of five alternatives for the proposed action. In one alternative, grazing would not be allowed on the installation (Alternative 1). Under the other four alternatives, including the preferred alternative, grazing would be allowed at stocking rates based on different management strategies (described below). Alternatives presented in the previous EA were not re-evaluated in this SEA.

Management

Grazing management, lease management, land improvements, and other similar issues are the same for all grazing alternatives. For Alternatives 1 and 5, where grazing will be deferred from the Eastern Training

Areas for at least one year, the brown-headed cowbird trapping program will be continued by the Fort Hood Natural Resources Management Branch.

Cowbird Trapping

Cowbird trapping will be continued on the installation under all alternatives described in this SEA. If the current lessee is selected to continue the lease, and an alternative is selected that allows grazing in the areas considered core endangered species habitat, trapping will be continued as described in the Memorandum of Understanding (MOU) related to cowbird trapping on the installation and on adjacent lands. Trapping on the adjacent private land may continue in the absence of an MOU, if the landowners decide to participate in the wildlife management property tax valuation program, but this would be beyond the control of the Army.

Yearly Forage Inventories

Under all grazing alternatives, each year a contractor hired by the Army, paid for by the lessee, will conduct a forage inventory using standard NRCS methodology to determine the amount of forage likely to be produced during that year in each of the Grazing Management Units, and to assess the ecological health of the areas using the NRCS indices described in the *National Pasture and Range Handbook* (USDA, 1997). The forage inventory data will then be used by the Army to calculate the stocking rate for the Grazing Management Units based on the residue maintenance strategy in the selected alternative as described below. The ecological health indices and trend analysis will be used by the Army to determine when or if grazing should be deferred from a Grazing Management Unit for the year.

Stocking Rates

One critical component of grazing management that will be consistent among the four grazing alternatives is that the number of cattle allowed to graze on the installation will be adjusted annually using the data from the yearly forage inventories. The four grazing alternatives are based on three different approaches for calculating stocking rates that represent different management strategies for maintaining the amount of vegetation (or residue) that should remain on a site after the cattle have grazed. For Alternatives 2, 3, and 4, each of the three stocking rate calculation approaches will be used for all Grazing Management Units. For Alternative 5, the Preferred Alternative, one of the three approaches is selected for each Grazing Management Unit based on the stocking strategy that best accommodates grazing and addresses the existing conditions of the land, potential soil erosion, and planned training activities.

Alternative 1 – No Grazing. For the No Grazing Alternative, the stocking rate on all Grazing Management Units would be zero.

Alternative 2 – 25 percent Harvest Efficiency. The NRCS uses the 25 percent Harvest Efficiency rule as their standard approach of calculating stocking rates for private landowners. The 25 percent Harvest Efficiency is considered a conservative method of calculating stocking rate, assuming no other activities are affecting the site. This approach is based on the premise that 50 percent of the forage on a site should be left ungrazed to provide cover for the soil and keep the vegetation healthy. The other 50 percent is made available to the grazing animal, but only half of that (25 percent of the total) is actually consumed by the animal. The other 25 percent is lost by the animal during the act of grazing by either dropping it to the ground or trampling on it. Thus, only 25 percent of the forage will be consumed via intake by

livestock. A detailed description of the calculation method is presented in the SEA, and the stocking rates resulting from this approach are presented in Table ES-1.

However, under this approach, other activities that may result in destruction or removal of the residual forage are not taken into account, therefore insufficient residue remains to maintain the ecological system. Additionally, this approach allows removal or loss of half of the forage present regardless of how little forage is available.

Table ES-1.
Approximate Stocking Rates (Animal Unit Years) for Fort Hood Grazing Outlease Alternatives for the Supplemental Environmental Assessment

Grazing Units	Total Acreage	Grazeable Acreage*	Alternatives				
			1 No Grazing	2 25% Harvest Efficiency	3 Maintenance Threshold	4 Conservation Threshold	5 Combined (Preferred)
Western Maneuver Area – North	34,961	33,151	0	685	367	255	0
Western Maneuver Area – South	32,305	30,296	0	444	54	14	0
West Fort Hood – North	4,407	4,251	0	203	194	180	203
West Fort Hood – South	10,471	9,855	0	196	128	102	0
Eastern Training Area – North	27,768	27,093	0	249	97	73	0
Eastern Training Area – South	22,678	21,976	0	166	85	74	0
North Fort Hood	3,993	3,843	0	163	147	126	147
Live Fire and Impact Areas	60,887	59,207	0	1,915	1,614	1,465	750**
Total	**197,470**	**189,672**	**0**	**4,021**	**2,686**	**2,289**	**1,100**

* "Grazeable Acreage" excludes those areas within the Total Acreage that were fenced to exclude cattle, relatively large areas of bare ground due to training or construction activities, and therefore are unable to produce forage.

** Maximum stocking rate established by Range Control to minimize training delays due to cattle.

Alternative 3 – Maintenance Threshold. The Maintenance Threshold approach to calculating stocking rates attempts to establish and maintain a minimal amount of residual vegetation on the ground after grazing. Currently, the Texas Cooperative Extension Service states that optimal amounts of ungrazed forage for mid-grass sites should range from 750 to 1,000 lbs/acre in order to maintain or improve rangeland health and reduce soil erosion. Ungrazed forage residue is important because it provides leaves and stems necessary to regenerate plant material removed during grazing, while at the same time it adds organic matter to the soil to improve soil structure, increase infiltration of water, reduces soil water loss, cools the soil, and reduces erosion.

For this alternative, the Maintenance Threshold is applied to all Grazing Management Units, and the objective is to maintain a 750 lb/acre or greater forage residue in order to maintain rangeland health and reduce erosion. Stocking rates for this strategy were calculated using the same forage production data for the ecological sites as described above. Stocking rate calculations under this alternative are inherently complex, particularly considering the Army's goal of maximizing the grazing opportunity when forage is present. Detailed descriptions of the calculations are included in the text of the SEA. In general,

ecological sites within a Grazing Management Unit producing less than the threshold value of 750 lbs/acre would not contribute to the stocking rate for the unit. For ecological sites producing 750 to 1,500 lbs/acre, the volume of forage above the 750 lbs/acre would be considered excess or available for grazing, and a stocking rate would be calculated, assuming 50 percent of the excess is consumed by the cattle. For ecological sites with greater than 1,500 lbs/acre, the standard 25 percent Harvest Efficiency is used. The results of these calculations using the May 2002 inventory data are presented in Table ES-1.

Alternative 4 – Conservation Threshold. The Conservation Threshold approach functions the same as the Maintenance Threshold, except that it sets an objective of maintaining 1,000 lbs/acre of forage residue. The higher forage residue promotes rangeland health and recovery and protects the soil from erosion. In general, ecological sites within a Grazing Management Unit producing less than the threshold value of 1,000 lbs/acre would not contribute to the stocking rate for the unit. For ecological sites producing 1,000 to 2,000 lbs/acre, the volume of forage above the 1,000 lbs/acre would be considered excess or available for grazing, and a stocking rate would be calculated, assuming 50 percent of the excess is consumed by the cattle. For ecological sites with greater than 2,000 lbs/acre, the standard 25 percent Harvest Efficiency is used. The results of these calculations using the May 2002 inventory data are presented in Table ES-1.

Alternative 5 – Combination Approach (Preferred Alternative). For Alternative 5, the Preferred Alternative, the Army selected the most appropriate stocking rate strategy from those discussed in the previous alternatives for each Grazing Management Unit in order to optimize grazing while taking into consideration available forage, type and frequency of other land uses for the unit, and potential for impacts to ecological health and soil erosion. Using the stocking rate strategies selected for each unit, the Army will use the data collected from the yearly forage inventories to calculate the potential stocking rate.

The Army will then use the ecological health indices and trend data collected during the yearly inventory to evaluate the condition of the vegetation and soil, and the forage inventories and the potential stocking rates to predict the potential for soil erosion in the units using the Revised Universal Soil Loss Equation (RUSLE) as described for assessing potential impacts below. If the ecological health indices and trend data indicate that the range conditions are poor or declining, or if the predicted soil erosion is greater than the acceptable rate of erosion for the area, the Army will defer grazing in the unit for the year.

Additionally, the Army imposed upper thresholds for stocking rates based on the potential for impacts to or conflicts with military training in the live fire and impact areas. As described in further detail in Section 4.1.1, training activities in these areas are often delayed when cattle wander into the line-of-fire or near the targets. When cattle enter these areas, training activities are halted (though not required to by the lease agreement), until military personnel can remove the cattle. The Army has determined that grazing more than 750 Animal Units (AUs) in this Grazing Management Unit would result in unacceptable delays to training activities.

The *Conservation Threshold* approach was determined to be the best calculation method for setting the stocking rate for the Western Maneuver Areas (North and South) because of the heavy training activities in the areas using tracked and wheeled vehicles, and the resulting impacts to vegetation and soil. Leaving the higher volume of forage to protect soil would improve the rate of recovery of the plant community. However, after calculating the potential soil erosion with the remaining forage, it was determined that grazing in this area should be deferred at least one year.

The *Maintenance Threshold* approach was selected for use in calculating stocking rates for the Eastern Training Area (North and South), North Fort Hood, and the Live Fire and Impact Areas because of the limited amount of training in those areas. However, after reviewing the ecological health indices from

2001 and calculating the potential soil erosion with the remaining forage in the Eastern Training Area, it was determined that grazing in this area should be deferred at least one year. As discussed above, the Army established that a maximum of 750 AUs would be allowed in the Live Fire and Impact Area. Coincidentally, at the 750 AU limit imposed due to impacts to training, the predicted soil erosion resulted in a Significance Factor of 0.99 which was only slightly below the threshold of 1.00 that is used for considering grazing deferment. Therefore, if a higher limit had been placed on the area, grazing may have been deferred for a year.

The *25 percent Harvest Efficiency* approach was selected for use in calculating the stocking rates in West Fort Hood (North and South) because of the lack of training activities in that area. However, after calculating the potential soil erosion with the remaining forage, it was determined that grazing in the southern portion of this area should be deferred at least one year.

Affected Environment

Fort Hood is located in central Texas in Bell and Coryell counties, about 35 miles southwest of Crawford, 58 miles north of Austin. The military installation encompasses about 87,940-hectares (ha) (217,300 acres), of which only about 80,332 ha (198,500 acres) are available for potential grazing, and much of that is forested. Many of the forested areas are habitat for two bird species, the Golden-cheeked warbler and the Black Capped Vireo, protected under the *Endangered Species Act*.

Land Use

Training activities in the live-fire and impact areas are shutdown temporarily for a variety of reasons, including cattle crossing the training ranges. Though not required in the lease agreements, all training activities on the ranges are halted when cattle enter the training ranges and are at risk of injury or death. Between October 2001 and October 2002, the total down time due to cattle was approximately 250 hours, or about 11 days.

Biological Resources

Over time, training activities, extensive continuous grazing by livestock, and suppression of wild fires have substantially altered the vegetative community on the installation. Military training activities, especially those involving tracked and wheeled vehicles, have disturbed or successfully eliminated many of the robust perennial plant species in open areas. Impacts of these disturbances are further exacerbated by livestock grazing because livestock have a tendency to graze the new shoots of the perennial herbaceous species that attempt to re-establish after the disturbance. Grazing immediately after disturbances does not allow the vegetation the proper rest needed to fully recuperate and gain vigor. Continuous grazing after soil disturbances has contributed to the decline in abundance of preferred perennial grass species and has promoted the invasion of less palatable perennial species and short-lived annual plants that have less extensive root systems, thus making the soil less resistant to erosion.

Additionally, military activities in combination with livestock grazing have reduced the presence of the fine fuels required to carry the range fires. Fires that became established were suppressed due to potential impacts to structures and the risk to human life. With the suppression of the fires, and the loss of competitive grasses due to military training and livestock grazing, Ashe juniper and other woody vegetation of the rocky slopes encroached into the grasslands, forming dense thickets in many areas, reducing forage production for livestock and wildlife.

In 2001, the NRCS conducted an inventory in the Western Maneuver Area, the Eastern Training Area, and West Fort Hood to estimate soil erosion and determine rangeland health and trend. The results indicated that productivity of grazeable perennial species declined compared to 1997 an average of 55 percent in West Fort Hood, 46 percent in the Eastern Training Area, and 76 percent in the Western Maneuver Area. Rangeland health (defined as the degree to which the integrity of the soil, the vegetation, the water, the air, and the ecological processes of the rangeland ecosystem are balanced and sustained) was found to be declining at the majority of the sites sampled in the Eastern Training Area and the Western Maneuver Area, with most sites being categorized as "at risk" or "not functioning." At West Fort Hood, approximately 60 percent of the monitored sites exhibited "stable" health (NRCS, 2002a).

Rangeland trend (a rating of the "direction" of change of the vegetation community relative to the historic climax plant community or some other desired plant community) was also assessed in the 2001 survey. In the Western Maneuver Areas, both short- and long-term rangeland trends were found to be declining on the majority of the sites. In the Eastern Training area, approximately half of the sites had downward trend (NRCS, 2002a). At West Fort Hood, the majority of sites exhibited an upward trend.

The primary conclusion of the 2001 rangeland health inventory was that declining rangeland health and trend on portions of the installation were the result of increased military training, continuous grazing of livestock without deferment, and the effects of multi-year droughts. The NRCS recommended that livestock and training deferments were needed in much of the Western Maneuver Area and portions of the Eastern Training Area to allow perennial vegetation to increase root biomass and recover.

Substantial effort is expended each year for conservation and monitoring of the Black-capped Vireos and Golden-cheeked Warblers on the installation, two bird species protected under the *Endangered Species Act*. Habitat for these species is found throughout the installation but is concentrated in the Eastern Training Area and in parts of the Live Fire and Impact Area. The primary grazing-related issue with conservation of these species is the fact that brown-headed cowbirds, known to be associated with grazing cattle, are nest parasites on these species. Nest parasites lay eggs in active nests of other birds so that the host birds will incubate the eggs, then feed and fledge the young of the parasitizing bird, often to the exclusion of the host's young.

To allow grazing within the core habitats of the installation, found in the Eastern Training Areas, an MOU was developed that allowed grazing in these areas to continue if the lessee, the CTCA, supported an off-site cowbird-trapping program. Under the MOU, the CTCA provides financial support for a government employee for trapping during the breeding season, maintaining 27 traps, and working with TPWD to gain voluntary legal access to the private lands adjacent to the installation in the targeted areas.

The cooperation between the CTCA, Fort Hood, TPWD, USDA Wildlife Services, the USFWS, and others resulted in a program that has reduced the impacts of the cowbird on the endangered bird species (as well as the non-endangered species) in the area, and allowed continued grazing in areas considered to be core habitat for the species. Currently, cowbird trapping is considered wildlife management and can be used to qualify lands for agricultural appraisal under a state-legislated wildlife management tax valuation. As of January 2003, over 400 traps were operational in the region under this program. Despite the effectiveness of the cowbird program on the installation, and the perceived connection between the Fort Hood Program and the state agricultural appraisal program, these programs are in no way related. If the Army determines, based on the vegetative inventories, that grazing must be deferred from the core endangered bird habitat to minimize impacts on soil, water, or other resources, thus nullifying the MOU, cowbird trapping will continue to be part of the statewide appraisal program.

Soil Resources

A large portion of the land area on Fort Hood has soils that have relatively high potential for soil erosion. The combinations of soil erodibility, slope, vegetation, disturbance regime, and climate all play important roles in influencing the amount of soil that erodes from a site. The ability of the soil to replenish itself and maintain plant growth is described as the soil loss tolerance. This is the acceptable amount of soil that can be lost in a year without harming plant productivity, thus allowing production to be sustained economically and indefinitely. Acceptable soil loss values range from 1 to 5 tons/acre/year for soils at Fort Hood. Values of 1 to 2 tons/acre generally indicate shallow or otherwise fragile soils, and 5 tons/acre/year indicates deep soils that are least subject to damage by erosion.

Soil erosion inventories were conducted by the NRCS in 2001 in conjunction with the rangeland health and trend analysis. Soil erosion (sheet and rill) was found to be highest in the Western Maneuver Area with an average loss of 6 tons/ac/year, with a range of 0.1 to 25.1 tons/ac/year, across 25 sampling points. The soil erosion data indicated that soil loss was greater than acceptable on 72 percent of the sites inventoried (25 monitoring points). NRCS attributed the high amounts of erosion to a large amount of bare ground and low amounts of vegetation residue on the soil surface. Bare ground averaged 78 percent across the sites and herbaceous perennial production averaged 445 lbs/ac. These conditions reflect the influence of drought conditions, military training, and continuous grazing without deferment on the soil and vegetation conditions. Soil erosion in the Eastern Training Area was found to average approximately 2 tons/ac/year across the sites monitored with a range of 0 to 7.8 tons/ac/year. NRCS concluded that 42 percent of the sites monitored exhibited soil erosion rates that exceeded acceptable soil loss rates. West Fort Hood was found to have the lowest erosion rates with an average soil loss of 0.7 tons/ac/year and a range of 0.1 to 3.0 tons/ac/year, with no sites found to have soil losses that exceeded acceptable limits. NRCS attributed this to the high amount of herbaceous perennial production (2,325 lbs/ac) and the lower amount of bare ground (25 percent) resulting from grazing deferments and lack of tracked vehicle use in the area. The higher amount of herbaceous production and increased surface residue protect the soil surface from erosion.

Economics

The Texas Agricultural Statistics Service website (http://www.nass.usda.gov/tx/cecatt1.htm) indicates that the inventory of cattle and calves in Bell and Coryell counties on 1 January 2002 were 47,000 and 68,000, respectively, for a total of 115,000 cattle and calves in the area most directly impacted by this lease.

Water Resources

Soil erosion from the installation has resulted in decreased water quality and substantial sedimentation in portions of Belton Lake as well as the smaller water bodies on the installation. Soil erosion management actions planned or implemented, as discussed in the current working INRMP, may reduce the sedimentation issue if the actions are fully implemented.

Recent water quality concerns in the Brazos River Basin have focused on fecal coliform contamination, believed to be contributed to by livestock raised in high densities on dairy farms. Portions of the Leon and Lampasas rivers and Nolan Creek were identified as exceeding the acceptable contaminant loads for fecal coliform (Texas Commission on Environmental Quality [TCEQ; formerly known as TNRCC], 2002). However, Cowhouse Creek, the primary drainage for the majority of the installation, which includes those areas most heavily grazed and having the highest erosion rates, had fecal coliform loads

within the acceptable standards (TCEQ, 2002). Based on this information, it is assumed that grazing on the installation has contributed little to the fecal coliform issues on the adjacent waterways.

Potential Impacts

The potential impacts from the five alternatives evaluated in this SEA are summarized in Table ES-2. Potential impacts on a few of the resources are discussed in more detail below.

Table ES-2.
Summary of Potential Impacts of the Grazing Outlease Alternatives

	Alt. 1 No Grazing	Alt. 2 25% Harvest Efficiency	Alt. 3 Maintenance Threshold	Alt. 4 Conservation Threshold	Alt. 5 Combined Strategy
Land Use, Air Space Use, and Visual Resources					
Land Use	None	Conflict with Training in Live Fire/Impact Area.	Conflict with Training in Live Fire/Impact Area.	Conflict with Training in Live Fire/Impact Area.	None
Airspace Use	None	None	None	None	None
Visual Resources	None	None	None	None	None
Biological Resources					
Flora	Recovery of vegetation communities in most areas.	Continued substantial decline in ecological health and condition.	Continued degraded vegetative community.	Recovery of vegetative communities where training is not persistent.	Recovery of vegetative communities where training is not persistent.
Fauna	None	No substantial impacts	None	None	None
Endangered Species	None	No substantial impacts	No substantial impacts	No substantial impacts	No substantial impacts
Earth Resources					
Soils	Reduced soil erosion	Continued significant soil erosion in many areas.	Continued significant soil erosion in some areas.	Reduced erosion in some areas, significant erosion in others.	Erosion rates lower in all areas.
Geology	None	None	None	None	None
Socioeconomics/ Env. Justice	None	None	None	None	None
Cultural Resources	None	Significant soil erosion could lead to significant impacts on resources.	Significant soil erosion could lead to significant impacts on resources.	Reduced erosion would not likely lead to impacts on cultural resources.	Reduced erosion would not likely lead to impacts on cultural resources.
Water					
Groundwater	None	None	None	None	None
Surface Water	None	High erosion in many areas could result in reduced water quality.	High erosion rates in some areas could result in reduced water quality.	High erosion rates in some areas could result in reduced water quality.	Reduced erosion throughout installation, potential impacts to water quality

	Alt. 1 No Grazing	Alt. 2 25% Harvest Efficiency	Alt. 3 Maintenance Threshold	Alt. 4 Conservation Threshold	Alt. 5 Combined Strategy
					minimal.
Noise, Air Quality, Utilities	None	None	None	None	None
Transportation	None	Slight increase in livestock-vehicle accidents.	None	None	None
Hazardous Materials/Items of Special Concern	None	None	None	None	None

Land Use

Cattle grazing in the Live Fire and Impact Areas has resulted in training delays due to cattle moving within the line of fire. This forces training activities to cease until the cattle are removed. For community relations, health, and safety reasons, gunnery training is halted when cattle are present on the range to allow a range crew to drive the cattle off, even though this is not required by the lease. Quantifying the significance of these impacts is difficult given the other causes of delay. From October 2001 through October 2002, training was halted 481 times, with each halt lasting at least 30 minutes. Therefore, almost 250 hours of training time was lost, which equates to 11 days. In addition to the direct loss of training time, suspension of training to clear cattle off the range complex has even greater second-order effects. The tempo of range operations is disrupted. Combat vehicle crews must stop and then attempt to restart systems, and resume the intended rhythm of the training scenario.

Though training and grazing can be compatible land uses in most areas at Fort Hood, the intensive and critical training activities that occur in the live fire and impact areas require additional restrictions on cattle densities in these areas. Training access to these ranges must be unobstructed or delayed in order to fulfill the semi-annual requirement to meet Army-mandated qualification standards. In addition, Fort Hood's increased involvement in the prosecution of the Global War On Terrorism (GWOT) will require more frequent gunnery exercises. Therefore, the total number of cattle in the Live Fire and Impact Areas, in total, shall not exceed 750 AUs (which represents the number that can reasonably be controlled without significant impacts on training).

Biological Resources

Alternative 1 – No Grazing. Under the No Grazing Alternative, perennial grasses and other desirable species likely would begin to re-establish throughout areas where the habitat is conducive for growth of those species, thus reversing the trend of declining range condition. Such a response to this change in land use may require several years of normal to above-normal precipitation. However, increased military activities would delay full recovery of the vegetation. Deferral of areas from military training through the Integrated Training Area Management (ITAM) out-area program would defer maneuvers in heavily impacted areas, thus accelerating the response of desirable perennial species under this alternative. In areas where woody shrubs and trees have become established to the exclusion of others, grazing and deferment alone generally will not lead to an increase in desirable perennial species. In this case, mechanical removal of woody shrubs and trees (e.g., juniper) or prescribed burns may be necessary to remove these invading shrubs and allow the desirable herbaceous species to become established.

Reseeding of areas with desirable species may also be required to accelerate a reversal of declining range condition.

Discontinuing grazing would likely benefit the Golden-cheeked Warbler and the Black-capped Vireo. The most substantial direct benefit for these species would be the expected reduction in the abundance, but not elimination, of brown-headed cowbirds on the interior portions of the installation, and the resulting reduction in brood parasitism by this species. A potential negative impact to the species would be the termination of the MOU with the CTCA that requires the CTCA to manage and support cowbird trapping on private lands adjacent to the Eastern Training Areas. However, cowbird trapping and shooting programs would be continued by Army staff. Assuming future results reflect past results, the parasitism rates likely would remain within the threshold of 10 percent established through formal consultation with the USFWS as an indicator of significant impact of cowbird parasitism on these species.

Alternative 2 – 25 percent Harvest Efficiency. Grazing under Alternative 2 likely would result in accelerated declining range condition and health in the majority of the ecological sites within the Eastern Training Area, Western Maneuver Area, and the southern portion of West Fort Hood because of the current poor condition of these sites. Although the 25 percent Harvest Efficiency calculation is considered a conservative calculation of stocking rate, it does not allow sufficient vegetation to be left after grazing as residue for protection from soil erosion on sites that are currently in poor condition. For example, many of the ecological sites in the Western Maneuver Area and the Eastern Training Area have grazeable perennial vegetation below 750 lbs/ac. The Texas Cooperative Extension service recommends a minimum of 750 to 1,000 lbs/ac acre of residue on mid-grass ecological sites. Since many of the sites within the Western Maneuver Area and Eastern Training Area are already at or below this residue threshold, the use of a 25 percent Harvest Efficiency for setting stocking rates on these sites will result in a loss of half of the forage, resulting in less residue, continued loss of desired perennial species, and continued decline in rangeland health. A confounding concern with the use of the 25 percent Harvest Efficiency for calculating stocking rates at Fort Hood is that the potential removal or loss of vegetation due to training activities is not considered. Half of the forage on a site is removed or lost to cattle production, then an unknown proportion of the remaining vegetation is lost or destroyed by training, leaving even less vegetation available as residue.

Since at least 1996 and until March 2002, the stocking rate for the installation was 3,500 AUs as designated in the 1996 lease. This stocking rate was calculated using the 25 percent Harvest Efficiency method. During that period, Fort Hood had not substantially adjusted stocking rates until March 2002 when a supplemental lease was implemented and stocking rate was decreased to 2,000 AUs. In 1997, NRCS conducted a vegetation inventory and rangeland condition analysis for the installation. At that time they noted that over 80 percent of the sites sampled on the installation had low rangeland similarity indices (25 percent or less), which means that very few of the sites were comparable to the historical climax plant community defined for those sites. During these efforts the NRCS also noted that rill and gully erosion was excessive in large portions of the Western Training Area, and that open prairies on the western side of Fort Hood were in very poor ecological condition. NRCS attributed these problems to excessive military training and excessive livestock grazing on open, flat topography.

After 4 years of grazing at 3,500 AUs, rangeland condition and health apparently did not improve. Results of the rangeland health and condition survey conducted in 2001 indicated that productivity of grazeable perennial species declined 55 percent, on average, in the West Fort Hood management units, 46 percent in the Eastern Training Area, and 76 percent in the Western Maneuver Area. NRCS concluded that these declines were the result of multiyear drought conditions, continuous grazing, and concentrated military training. Rangeland health was found to be declining at the majority of sites sampled in the Eastern Training Area and the Western Maneuver Area. In both areas, approximately 80 percent of the sites had declining rangeland health conditions.

Under this alternative, the stocking rate for the installation would be 4,021 AUs. Based on historical trends at the site and with the current levels of military training in the Western Maneuver Area and Eastern Training Area, there is no evidence that any improvement in rangeland health and condition would occur in these areas. Therefore, it is expected that this alternative would lead to significant impacts to flora in the Western Maneuver Area and the Eastern Training Area, and possibly other areas after several years into the lease.

Grazing throughout the installation at the stocking rates under this alternative likely would result in impacts to the Golden-cheeked Warbler and Black-capped Vireo in the form of brown-headed cowbird parasitism. However, implementation of the cowbird trapping and shooting programs has been shown to reduce parastitism to below 10 percent, a rate considered acceptable by the USFWS (USFWS, 2000). Under this alternative, the trapping and shooting programs would continue, run by the lessee or the Natural Resources Management Branch (NRMB), in order to keep parasitism rates within this threshold.

Alternative 3 – Maintenance Threshold. Under Alternative 3, a minimum residue of 750 lbs/ac would be maintained on areas that are already producing this much perennial herbaceous vegetation. On areas producing less than 750 lbs/ac of perennial herbaceous vegetation, no stocking rate would be assigned and grazing would be deferred for the year. The implementation of this alternative would most likely lead to maintenance of current conditions. Since these areas are at the low end of the residue threshold recommended by the Texas Cooperative Extension Service, recovery of vegetation would be slower than at sites having higher residue. In areas having perennial herbaceous vegetation already below the maintenance threshold (e.g., the majority of ecological sites within the Western Maneuver Area and the Eastern Training Area) this alternative would likely lead to a slight improvement in rangeland health. However, given the already poor condition of these sites, years of above average rainfall would most likely be required for substantial range improvement. Also, any increased military activities could lead to a reduction in vegetation below the maintenance threshold, thus reducing any positive effects that this stocking rate would have on perennial vegetation and ecological condition. For substantial improvement in the range condition, training activities would have to be reduced and extensive revegetation and restoration would be required.

Maintenance of a 750 lb/ac residue threshold should not lead to increased probability of wildfires. The minimum amount of continuous fine fuel required to carry a fire in this region is about 1,000 lbs/ac. However, the vegetation residue provided by this alternative would not lead to an effective prescribed burning program. Deferment of areas from grazing and military activities would be required to make prescribed burning efficient for reduction of invasive woody species.

Alternative 4 – Conservation Threshold. Under Alternative 4, a minimum residue of 1,000 lbs/ac would be maintained on areas that are already producing this much perennial herbaceous vegetation. On areas not producing 1,000 lbs/ac of perennial herbaceous vegetation, no stocking rate would be assigned. The implementation of this alternative would most likely lead to a slight to moderate improvement in current conditions. In areas having perennial herbaceous vegetation already below the conservation threshold (e.g., the majority of ecological sites within the Western Maneuver Area and the Eastern Training Area) this alternative would likely lead to slight increases in desired species and increased vigor in already established plants. However, given the already poor condition of these sites, above average rainfall would most likely be required for an upward trend in ecological condition. Also, any increased military activities that would lead to a reduction in vegetation below the conservation threshold would reduce any positive effects that this stocking rate would have on perennial vegetation and ecological condition.

Maintenance of a 1,000 lbs/ac residue threshold could lead to increased probability of wildfires. The minimum amount of continuous fine fuel required to carry a fire in this region is about 1,000 lbs/ac. Impacts to vegetation caused by wildfires are most likely to be positive in that invasive shrubs would

likely be reduced. The vegetation residue provided by this alternative would provide fine fuel needed for a prescribed burning program, but a 1,000 lb/ac fine fuel load is considered sub-optimal for killing of invasive juniper seedlings. Deferment of areas from grazing and military activities would be required to allow fine fuel build-up to make prescribed burning efficient for reduction of invasive woody species.

Alternative 5 – Combined Approach. Under the Preferred Alternative, Alternative 5, grazing will be deferred in the management units within the Western Maneuver Area, Eastern Training Area, and the southern portion of West Fort Hood due to the significant impacts on soil. Under this alternative deferment of grazing will allow the vegetation to make progress toward improved range condition if adequate precipitation occurs. Recovery of these areas could be rapid following deferment. A brief but significant reduction in stocking rate in the Eastern Training Area during 1996 to 1998 resulted in a significant increase in biomass production of herbaceous grassland species. In areas of continuing military activities, the deferment of grazing would allow the herbaceous perennial vegetation to become re-established despite the maneuver activities. Localized over-grazing on these disturbances would be reduced and damaged plants would be able to resprout and grow to a size that would withstand moderate grazing. Continued deferment of these areas over a number of years would minimize the potential recurrence of the substantially reduced ecological health observed in these areas, especially in average to above average rainfall years. Any increased military training activities or lack of training deferment on these areas would slow the recovery of vegetation caused by a deferment of grazing. Vegetation inventories should be conducted during the deferment period to monitor changes in rangeland health and to assess whether grazing could be re-initiated to remove vegetation residue and reduce risk of wildfire.

Under this alternative, grazing in the North Fort Hood management unit would be conducted using stocking rates that maintain a 750 lbs/ac residue threshold. This would most likely lead to maintenance of current conditions. In areas having perennial herbaceous vegetation already below the maintenance threshold this alternative would likely lead to a slight increase in rangeland health. Military activities are generally light in this area, so the combination of grazing and military activities should not lead to further declines in rangeland health and condition. Also, the probability of wildfires should not increase since at least 1,000 lbs/ac of continuous fine fuel is required to carry a fire.

Under this alternative, the northern portion of West Fort Hood would be grazed using stocking rates determined with the 25 percent Harvest Efficiency method. Since the majority of ecological sites within this management unit are already in good ecological condition, grazing under this stocking rate should not lead to a decline in rangeland health. However, this stocking rate should be reassessed if drought conditions occur and/or military activities increase in this area.

In the Live Fire Area, the maximum number of animal units that will be allowed to graze are 750 AUs based on impacts to training activities. Given the perennial grazeable vegetation resource in this management unit, the 750 AUs equates to a light stocking rate. However, even at the light stocking rate, the predicted soil erosion resulted in a Significance Factor of 0.99, which is only slightly below the threshold of 1.00 that is used for considering grazing deferment. Therefore, if a higher limit had been placed on the area, grazing may have been deferred for a year.

Under this alternative, slight to moderate increases in desired species would be expected and vigor would be increased in already established plants. In areas of this management unit already in poor condition, above average rainfall would most likely be required for an upward trend in ecological condition to occur. Portions of this management unit have high productivity, thus increasing the risk of wildfire. Fort Hood has an active prescribed burning program in this management unit to reduce the risk of range fires associated with military training. Therefore the risk of wildfire in this area should be minimal.

Soils

To assess impacts to soils for the five proposed alternatives, the Revised Universal Soil Loss Equation (RUSLE 1.6) was used to determine potential soil loss from water erosion. The RUSLE model was developed and revised by the USDA, Agricultural Research Service (ARS), for assessing water erosion on a variety of range types (including native rangelands) and land uses. Though the NRCS does not use the RUSLE model in Texas for predicting erosion on rangelands, a number of other agencies do, including the Arizona Cooperative Extension Service (Jones, 2001); Bureau of Land Management (BLM); United States Army Corp of Engineers (USACE); NRCS in New Mexico and Florida; and the U.S. Department of Interior-Office of Surface Mining, Reclamation, and Regulation.

The RUSLE model requires site-specific information on vegetation cover, climate, soil erodibility, slope characteristics, and disturbance regime/history. The NRCS' Soil Survey Geographic (SSURGO) databases for Bell and Coryell counties were used to extract soil information for the individual soils analyzed within each management unit. Soil erosion estimates were conducted on individual soils within the management units that comprised a cumulative total of at least 50 percent of the land area. The 50 percent cumulative total was used in order to allow the major soils to be represented within each management unit. The acreage of individual soils within each management unit was determined by intersecting the SSURGO database map layer with the ecological site/management unit map layer using geographic information system software. The major soils were then identified using database software.

Plant biomass values are also required by the RUSLE model for estimation of soil erosion. In the comparison of alternatives, the plant biomass values used to parameterize the RUSLE model were derivations of the perennial consumable forage values from the May 2002 inventory that were used to calculate stocking rates for each of the alternatives. Perennial consumable forage was used because this is the component of the residue cover that is most impacted by grazing (e.g. perennial grasses), and it best reflects the management goals of residue thresholds for Alternatives 3 and 4. Also, perennial consumable forage biomass was used in previous erosion estimates on the installation, thus allowing continuity with previous activities. Although other perennial vegetation was present on some of the ecological sites, this amount was generally less than 200 lbs/acre for the majority of the soils examined for erosion. The species comprising this biomass were generally forbs (e.g., ragweed, antelope-horns, and frog-fruit) that do not provide the same erosion protection as the perennial grasses. In addition, total perennial biomass was not collected in the Live Fire/Impact area as visual estimates of the perennial consumable biomass were made. Therefore, the use of perennial consumable biomass allows comparison of all alternatives in all management units on the installation.

To ascertain the plant biomass values for each of the major soil types within the management units to be used for parameterizing the RUSLE model, the ecological site/management unit map layer containing the perennial consumable forage was intersected with the SSURGO soil map layer using geographic information system software. Plant biomass values were summarized by management unit and major soil type using area weighted averaging (i.e., in calculating the average biomass, biomass values were weighted proportionally to the amount of acres of the soil type within each management unit). When conducting soil erosion estimates in the RUSLE model for each of the major soil types within each management unit, the amount of plant biomass entered into the model was adjusted to reflect the influence of grazing under each of the alternatives as follows:

- Alternative 1 – No Grazing: All of the perennial consumable biomass was entered.
- Alternative 2 – Standard Method: 50 percent of the perennial consumable biomass was entered to reflect that 50 percent of the vegetation remains as residue under this alternative.

- Alternative 3 – Maintenance Threshold: Actual perennial consumable biomass for sites having less than 750 lbs/ac, 750 lbs/ac for sites having between 750 and 1,500 lbs/ac, and 50 percent of the perennial consumable biomass for sites having greater than 1,500 lbs/ac.
- Alternative 4 – Conservation Threshold: Actual perennial consumable biomass for sites having less than 1,000 lbs/ac, 1,000 lbs/ac for sites having between 1,000 and 2,000 lbs/ac, and 50 percent of the biomass for sites having greater than 2,000 lbs/ac.
- Alternative 5 – Combined alternative: Actual perennial consumable biomass for soils within the Western Maneuver Area, Eastern Training Area and the southern portion of West Fort Hood. 750 lbs/ac for North Fort Hood. 50 percent of the perennial consumable biomass for the northern portion of West Fort Hood. 80 percent of the perennial consumable biomass for the Live Fire Area was entered (the 750 AU limit in the Live Fire Area equates to a 10 percent Harvest Efficiency in this management unit, therefore the amount actually removed by the grazing animal is 20 percent, with 80 percent of the vegetation remaining as residue).

Once soil erosion estimates were determined for each of the major soils within the management units (see Table 4-2), the area weighted averaging approach was used to determine the average amount of potential soil erosion within the management units for each of the alternatives. This was accomplished by multiplying the RUSLE estimated soil erosion by the number of acres for each soil type. These numbers were then summed within the management unit and divided by the total number of acres of the major soils. This provided a weighted average erosion estimate for each management unit under each alternative. The acceptable soil loss tolerances (soil T factor) for each of the major soils were also subjected to area weighted averaging so that an average acceptable soil loss for each management unit could be identified. For each of the various alternatives, the average potential soil erosion within a management unit was divided by the average acceptable soil loss to calculate a significance factor. Alternatives having Significance Factors exceeding 1.0 were considered to have significant impacts, meaning that if the expected rate of erosion was greater than what was deemed acceptable for the soils in the unit, the impacts would be significant (presented in Table ES-3). It should be noted that RUSLE estimates of water erosion under the alternatives reflect potential sediment yield given the plant biomass, soil erodibility, and landscape attributes used to parameterize the model (Appendix B) and are used here to allow a relative comparison of soil erosion under each of the alternatives as they are influenced by cattle grazing. Effects of the combination of cattle grazing and increased military activities were not analyzed.

Alternative 1 – No Grazing. Under this alternative, deferment of grazing in the Western Maneuver Area and Eastern Training Area would likely result in a recovery of the vegetation communities allowing perennial herbaceous plant production and vigor to increase and the amount of plant residue to increase. Over time, soil erosion would likely decrease to tolerable limits with continued deferment. However, any increase in military activities on sites already having erosion exceeding tolerable limits would likely lead to continued erosion and declining rangeland condition. As stated previously, areas within these management units may require reseeding, brush removal, and revegetation to accelerate the process of upward rangeland trend and to provide the perennial herbaceous cover to protect the soil. Each of these activities will lead to soil disturbance, therefore erosion protection measures should be considered to insure that erosion at revegetated sites does not exceed tolerable limits.

Erosion is estimated to be within tolerable limits under this alternative in the Live Fire Area, North Fort Hood, and in the northern portion of West Fort Hood. Deferment of grazing would allow perennial herbaceous plant production and vigor to increase in these areas leading to further decreases in soil erosion.

Table ES-3. Acceptable soil loss tolerances (T), potential average annual erosion rates (A) (tons/ac/year) from the RUSLE 1.06 erosion prediction model, and significance factor (A/T) for Grazing Management Units for each of the alternatives.

Management Units [a]	*Acceptable Soil Loss (T) (tons/ac/yr)*	*Alternative 1* No Grazing		*Alternative 2* 25% Harvest Efficiency		*Alternative 3* Maintenance Threshold		*Alternative 4* Conservation Threshold		*Alternative 5* Combined Approach (Preferred Alt.)	
		Erosion (A)	*Sign. Factor (A/T)* [b]	*Erosion (A)*	*Sign. Factor (A/T)*	*Erosion (A)*	*Sign. Factor (A/T)*	*Erosion (A)*	*Sign. Factor (A/T)*	*Erosion (A)*	*Sign. Factor (A/T)*
WMA-North	3.27	4.73	1.45	6.87	2.10	5.19	1.59	4.76	1.46	4.73	1.45
WMA-South	3.14	5.10	1.62	6.51	2.07	5.10	1.62	5.10	1.62	5.10	1.62
WFH-North	5.00	1.19	0.24	4.22	0.84	4.22	0.84	4.17	0.83	4.22	0.84
WFH-South	3.95	4.81	1.22	7.10	1.80	4.81	1.22	4.81	1.22	4.81	1.22
ETA-North	1.40	4.13	2.94	4.89	3.48	4.13	2.94	4.13	2.94	4.13	2.94
ETA/South	2.28	3.10	1.36	3.47	1.52	3.10	1.36	3.10	1.36	3.10	1.36
NFH	2.94	1.72	0.58	3.37	1.15	2.89	0.98	2.30	0.78	2.30	0.78
LFI	3.74	3.02	0.81	5.92	1.58	5.12	1.37	4.37	1.17	3.72	0.99

a
WMA-North North portion of the Western Maneuver Area
WMA-South South Portion of the Western Maneuver Area
WFH-North North portion of West Fort Hood
WFH-South South portion of West Fort Hood
ETA-North North portion of the Eastern Training Area
ETA-South South portion of the Eastern Training Area
NFH North Fort Hood
LFI Live-Fire and Impact Areas

b The "significance factor" refers to the ratio of the potential erosion rate (A) to the acceptable soil loss (T). Any value above 1.0 is considered to be a significant impact. Specific variables for each of the soils and management units used are given in Appendix B.

Alternative 2 – 25 percent Harvest Efficiency. Under this alternative, soil erosion is estimated to have significant impacts in all management units except the northern portion of West Fort Hood (Table ES-3). Under this alternative, approximately half of the perennial herbaceous vegetation remains after grazing. In areas where perennial vegetation biomass is already low, grazing will lead to further removal of this vegetation, which leads to higher estimated erosion losses because the soil does not have adequate protection. Estimated erosion was calculated to be the highest in the northern portion of the Eastern Training Area (4.89 tons/ac/year), which is 3.48 times the tolerable limits for the soils. In the Western Maneuver Area, erosion was estimated to be 6.87 tons/ac/year for the northern portion and 6.51 tons/ac/year for the southern portion. Each area is estimated to have approximately double the acceptable soil losses for these areas (Table ES-3).

This alternative does not allow adequate recovery of the vegetation resource in areas where rangeland condition has already deteriorated, thus it is expected to lead to continued increases in soil erosion over time. As stated previously, the 25 percent Harvest Efficiency method does not allow sufficient vegetation to be left after grazing as residue for protection from soil erosion on sites that are currently in poor condition. This method also fails to take into consideration forage lost through military activities. As discussed in Section 4.2.2, the 25 percent Harvest Efficiency method has been used to calculate stocking rates on the site since at least 1996. Since that time, erosion rates have been documented to exceed tolerable limits and rangeland health has declined in both the Western Maneuver Area and Eastern

Training Area. Under this alternative, the stocking rate for the installation would be 4,021 AUs compared to the 3,500 AUs allowed to graze from 1996 to 2002. Based on historical trends at the site and with the current levels of military training in the Western Maneuver Area and Eastern Training Area, there is no evidence that any improvement in rangeland health and condition would occur in these areas that would lead to reduced erosion. Therefore, it is expected that this alternative would lead to significant impacts to soils in these management units and lead to soil losses exceeding tolerable limits in the other management units except for the northern portion of West Fort Hood.

Alternative 3 – Maintenance Threshold. Under this alternative, grazing was estimated to have significant impacts on soil resources in all management units except North Fort Hood and the northern portion of West Fort Hood (Table ES-3). Predicted erosion in the Eastern Training Area, Western Maneuver Area, the Live Fire Area, and the southern portion of West Fort Hood management units are 1.2 to 2.9 times the tolerable limits for soils in those areas (Table ES-3). Because stocking rates under this alternative are calculated assuming areas with perennial herbaceous vegetation already below the maintenance threshold of 750 lbs/ac do not contribute to "available forage" (e.g., the majority of ecological sites within the Western Maneuver Area and the Eastern Training Area), this alternative would likely lead to a slight improvement in rangeland health in those areas. However, given the already poor condition of these sites, and the fact that these sites cannot be segregated and protected from grazing by cattle allowed in the unit, years of above average rainfall would most likely be required before any significant increase in perennial vegetation biomass would be able to reduce erosion on these sites. Under this alternative, the maintenance threshold would have to be maintained both from a grazing and military activity standpoint. Increased military activities that would lead to a reduction in vegetation below the maintenance threshold would reduce any positive effects that this stocking rate would have on perennial vegetation and ecological condition, thus leading to increases in erosion over the estimated amounts.

Alternative 4 – Conservation Threshold. Soil erosion estimates for management units under this alternative indicate that significant impacts to soils would result in the Eastern Training Area, Western Maneuver Area, the Live Fire Area, and the southern portion of West Fort Hood (Table ES-3). Soil erosion estimates in these areas ranged from 3.10 to 5.10 tons/ac/year, which are 1.2 to 2.9 times acceptable tolerance limits for those areas. In the North Fort Hood and the northern portion of West Fort Hood management units, erosion was within tolerable limits (Table ES-3).

The implementation of this alternative would most likely lead to a slight to moderate improvement in herbaceous perennial vegetation conditions, thus reducing erosion over time. In areas having perennial herbaceous vegetation already below the conservation threshold (e.g., the majority of ecological sites within the Western Maneuver Area and the Eastern Training Area) this alternative would likely lead to a slight increase in desired species and increased vigor in already established plants. However, given the already poor condition of these sites, above average rainfall would most likely be required for any substantial improvement in ecological condition. Under this alternative, the conservation threshold would have to be maintained for both grazing and military activities. Increased military activities that would lead to a reduction in vegetation below the conservation threshold would reduce any positive effects that this stocking rate would have on perennial vegetation and ecological condition.

Alternative 5 – Combined Approach, Preferred Alternative. Under this alternative, ecological health indices and erosion estimates indicate that significant impacts to soils would occur in the Western Maneuver Area, Eastern Training Area, and the southern portion of West Fort Hood management units, as discussed under the No Grazing Alternative (Table ES-3). Therefore grazing will be deferred in these management units for at least one year, resulting in grazing having no contributing effect to soil erosion in these areas under implementation of this alternative. Deferment of grazing in these management units will allow the vegetation to recover given adequate precipitation, thus increasing ground cover to reduce erosion. However, any increases in military activities will reduce any benefits of grazing deferment and

lead to increased erosion in these management units. Implementation of the Integrated Training Area Management out-area program would allow areas within Western Maneuver Area and Eastern Training Area to have periodic deferment from military activities, thus allowing vegetation to recover and provide protection of the soil from erosion.

The North Fort Hood, Live Fire Area, and the northern portion of West Fort Hood have soil erosion estimates that fall within the tolerable limits under this alternative (see Table 4-3). Slight to moderate increases in ecological condition would be expected in these areas given average to above average rainfall conditions, thus leading to reduced erosion over time. However, any increase in military activities in these areas, especially in the Live Fire Area, could lead to erosion exceeding tolerable limits.

Conclusions

Based on the information and analyses presented in this SEA, the Proposed Action would not likely have significant adverse impacts on the quality or the integrity of the human or natural environments. Therefore, an Environmental Impact Statement will not be prepared for the Fort Hood Grazing Outlease Program.

Preferred Alternative

Resource Managers at Fort Hood selected the Combination Strategy (Alternative 5, Preferred Alternative in the SEA) to be the proposed alternative for this SEA. This alternative was selected for the following reasons:

- No significant impacts to the environment were identified,
- Maximized grazing in areas where ecological condition is good and erosion is minimal,
- Stocking rates would be adjusted at least annually based on the availability of the forage,
- Balances potential for grazing and need to control erosion, and
- Provides the Army increased ability to minimize training shutdowns due to cattle.

Non-Preferred Alternatives

Though no short-term significant impacts were identified for the "No Grazing" alternative (Alternative 1), the potential for increased litter in areas that are ungrazed could lead to additional wild fires on and around the installation. Additionally, forage inventories show that areas on the installation have sufficient excess forage and these areas could support grazing and could be made available with no impacts to the training mission or the natural resources.

Analyses of each of the other three grazing alternatives (Alternatives 2, 3, and 4) indicate that grazing at the resulting stocking rates of those alternatives would result in erosion at levels greater than those identified as acceptable for the soil types in at least one of the Grazing Management Units. Significant levels of erosion lead to potential impacts to water quality through sediment loading, cultural resources through exposure of the resources, continued decline in native vegetation, and eventual loss of ecological integrity of the land.

Conclusion

Based on the information and analyses presented in this SEA, the Proposed Action would not likely have significant adverse impacts on the quality or the integrity of the human or natural environments. Therefore, an *Environmental Impact Statement* will not be prepared for the Fort Hood Grazing Outlease Program.

1.0 INTRODUCTION

Fort Hood dates to 1942 when the Army established Camp Hood to prepare soldiers for tank destroyer combat during World War II. Renamed Fort Hood, it became a permanent installation in 1950. Fort Hood Military Reservation is an 87,940-hectare (ha) (217,300-acre) U.S. Army installation located in central Texas (Figure 1-1). Fort Hood provides resources and training facilities for active and reserve units of the Army to support the Army's mission to maintain a total force that is trained and ready to fight, to serve our nation's interests both domestically and abroad, and to maintain a strategic force capable of decisive victory. Fort Hood is one of the Army's premier installations in support of this mission because the full range of mission-related training activities are conducted on Fort Hood including maneuver exercises for units up to brigade level, firing of live weapons, and aviation training (U.S. Army Corps of Engineers [USACE], 2000).

The installation provides the infrastructure and training lands for the 1st Cavalry Division and the 4th Infantry Division, III Corps Headquarters (III Corps) and its combat aviation assets, combat support, and combat service support units. With increased emphasis on force structure changes and Base Realignment and Closure (BRAC) initiatives, Fort Hood will likely remain the largest active U.S. installation in terms of assigned personnel. Total assigned personnel authorization is approximately 45,000 soldiers (USACE, 2000).

1.1 PURPOSE OF AND NEED FOR THE PROPOSED ACTION

The purpose of the proposed action is to generate a new lease agreement for the grazing program at Fort Hood. Fort Hood was established when the Federal Government condemned private lands in the area, paying the landowners fair market value for the lands. As an additional benefit to the previous landowners, the Army agreed to extend a 5-year lease to allow continued grazing of the land. The landowners formed the Central Texas Cattlemen's Association (CTCA) to act as a unified entity in managing the cattle on the land, with each of the former landowners retaining an interest in the CTCA equivalent to the amount of land they lost to the condemnation. This lease has been renewed continuously.

In 2000, the Army generated an *Environmental Assessment* (EA) of the proposed renewal of the lease to extend through 2004. In that EA, the Army determined that grazing could occur on the installation but only at a significantly reduced stocking rate and with deferral of grazing in portions of the installation. Numerous agencies and individuals (e.g., Texas Parks and Wildlife Department [TPWD], Texas Department of Agriculture) and individuals contended that the grazing management strategies were too complicated and that the stocking rate calculations were based on incomplete forage inventories and forage availability data. The Army agreed to revisit the stocking rate calculations and revise the EA when the U.S. Department of Agriculture (USDA) agreed to have the Natural Resources Conservation Service (NRCS) conduct a forage inventory across the installation in May 2002.

This *Supplemental Environmental Assessment* (SEA) evaluates the potential impacts of the revised alternatives using the new forage inventory data.

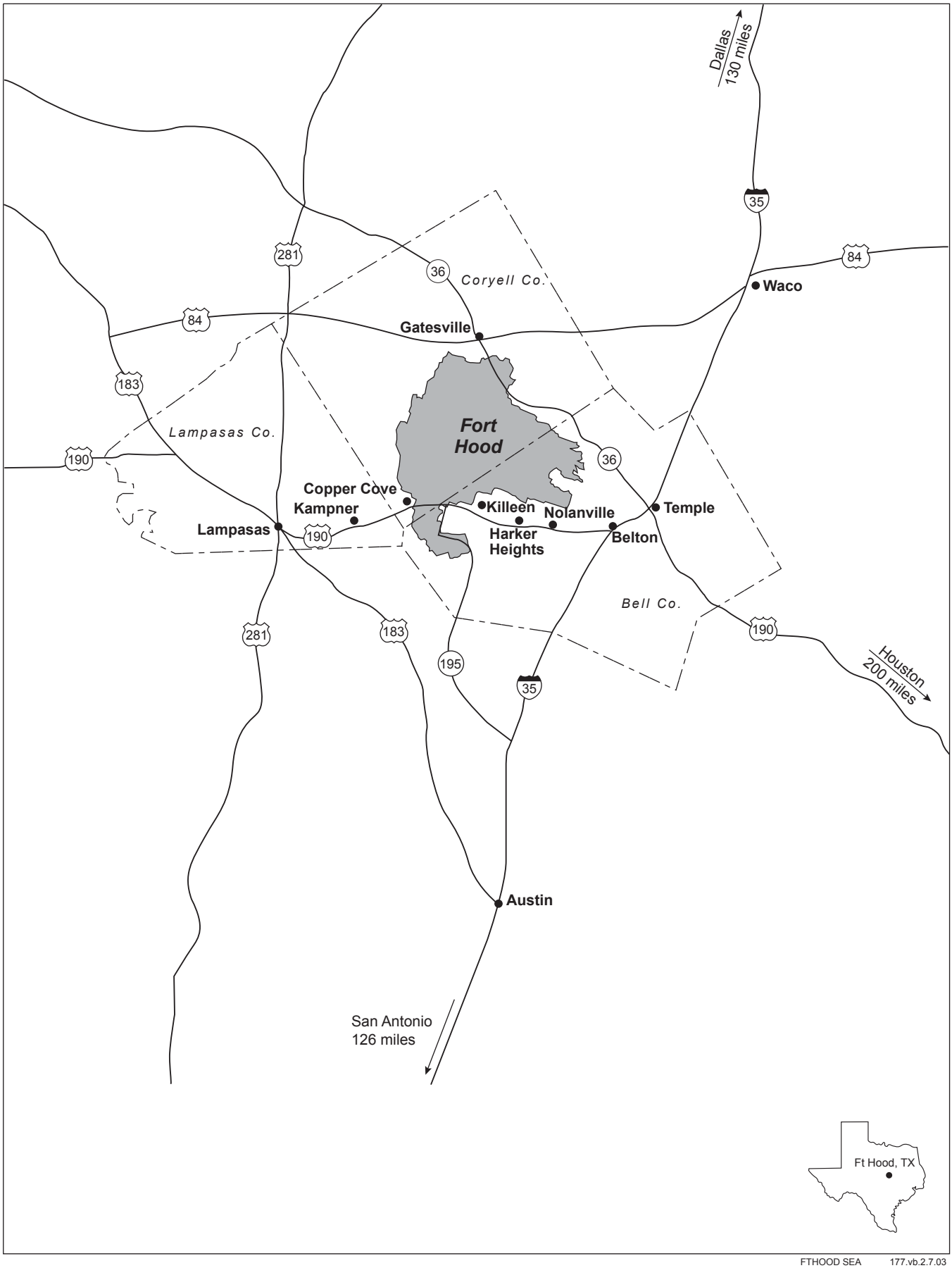

Figure 1-1. Fort Hood Military Reservation Vicinity Map.

1.2 COMPLIANCE WITH REGULATORY REQUIREMENTS

The *National Environmental Policy Act* (NEPA) (Public Law [PL] 91-190, 1969) requires federal agencies to consider the environmental consequences of all proposed actions in their decision-making process. The intent of the NEPA is to protect, restore, or enhance the environment through a well-informed decision-making process. The Council on Environmental Quality (CEQ) was established under the NEPA to implement and oversee federal policy in this process. To this end, the CEQ issued the *Regulations for Implementing the Procedural Provisions of NEPA* (40 Code of Federal Regulations [CFR] 1500-1508, 1993). U.S. Army Regulation (AR) 200-2 implements the CEQ regulations within the Army. The CEQ regulations and AR 200-2 provide for the periodic review of continuing activities to ensure that the setting, actions, and effects that may have been previously assessed remain substantially accurate, particularly if changes in operation have occurred or are planned. This document assesses the environmental impacts associated with the implementation of revisions to the grazing program at Fort Hood.

AR 405-80, 10 October 1997, Section 4-8, Management of Title and Granting Use of Real Property. "The Department of the Army (DA) will not authorize the use of real property, water, or other natural resources when the use conflicts with the goals and intent of overall Federal policy on environmental quality and historical preservation. All actions will comply with applicable Federal and state environmental, historical, and cultural protection requirements as well as any applicable coastal zone management plans, flood plain, and wetland management (see AR 200-2)."

Table 1-1 lists the other laws and regulations reviewed in the development of this SEA.

In addition, in August 1999 the DA released Department-wide guidance on *Reimbursable Agricultural/Grazing and Forestry Programs* (U.S. Army, 1999b). The guidance provides general criteria for installation managers to determine whether such programs can be implemented on the installation. The guidance states that outleasing and harvesting activities shall be conducted in such a manner as to support mission operations, support conservation compliance, and execute natural resources stewardship (e.g. maintain healthy ecosystems). Below are relevant excerpts from the guidance and the transmitting letter from the Assistant Chief of Staff for Installation Management (ACSIM) (U.S. Army, 1999b).

- "Reimbursable agricultural/grazing and forestry activities are opportunities for planning and managing the landscape (i.e., the appearance and natural characteristics of the area) to fit the needs of the mission. Outleasing and harvest of forest products shall be conducted in such a manner to support mission operations, support conservation compliance, and execute natural resources stewardship, e.g. maintain healthy ecosystems, sustain biodiversity." (Section 2.a.)

- "Installation mission operations personnel (e.g., installation G-3, Directorate of Plans, Training, Mobilization, and Security (DPTMS) staff or equivalent and testing counterparts) shall determine optimum mission landscape requirements (i.e., ecosystem characteristics) in consultation with installation conservation personnel." (Section 2.b.)

- Sustained reimbursable activities "must support the mission" of the installation. The activity "must not encumber land that is needed for conducting mission operations." The Natural Resource Managers "must coordinate with mission operators to identify opportunities to improve long-term mission access to land, increase training realism, and improve training flexibility." (Section 3.a(5)(a)).

Table 1-1. Other Major Federal Environmental Statutes, Regulations, and Executive Orders Applicable to Federal Projects

Environmental Resource	*Statutes*
Air	*Clean Air Act* of 1970 (PL 95-95), as amended in 1977 and 1990 (PL 91-604); EPA, Subchapter C-Air Programs (40 CFR 52-99)
Noise	*Noise Control Act* of 1972 (PL 92-574) and Amendments of 1978 (PL 95-609); EPA, Subchapter G-Noise Abatement Programs (40 CFR 201-211)
Water	*Federal Water Pollution Control Act* of 1972 (PL 92-500) and Amendments; *Clean Water Act* of 1977 (PL 95-217); EPA, Subchapter D-Water Programs (40 CFR 100-149); *Water Quality Act* of 1987 (PL 100-4); EPA, Subchapter N-Effluent Guidelines and Standards (40 CFR 401-471); *Safe Drinking Water Act* of 1972 (PL 95-523) and Amendments of 1986 (PL 99-339); EPA, National Drinking Water Regulations and Underground Injection Control Program (40 CFR 141-149)
Land	*Federal Land Policy and Management Act* of 1976 (PL 94-579); *Engle Act* of 1958 (43 United States Code [USC] 155); *Military Lands Withdrawal Act* (PL 99-606); Land Withdrawal regulations (43 CFR 2300); *Public Rangelands Improvement Act* of 1978; *Wilderness Act* of 1964 (PL 88-577); *National Forest Management Act* of 1976 (PL 94-588)
Biological	*Migratory Bird Treaty Act* of 1918; *Bald and Golden Eagle Protection Act* of 1940 (16 USC 5A) 35 ref); *Fish and Wildlife Coordination Act* of 1958 (PL 85-654); *Sikes Act* of 1960 (PL 86-797) and Amendments of 1986 (PL 99-561) and 1997 (PL 105-85 Title XXIX); *Endangered Species Act* of 1973 (PL 93-205) and Amendments of 1988 (PL 100-478); *Fish and Wildlife Conservation Act* of 1980 (PL 96-366); *Lacey Act Amendments* of 1981 (PL 97-79)
Wetlands and Floodplains	Section 401 and 404 of the *Federal Water Pollution Control Act* of 1972 (PL 92-500); EPA, subchapter D-Water Programs 40 CFR 100-149; Floodplain Management – 1977 (Executive Order [EO] 11988); Protection of Wetlands - 1977 (EO 11990); *Emergency Wetlands Resources Act* of 1986 (PL 99-645); *North American Wetlands Conservation Act* of 1989 (PL 101-233)
Cultural	*National Historic Preservation Act* of 1966 (16 USC 470 et seq.) (PL 89-665) and Amendments of 1980 (PL 96-515) and 1992 (PL 102-575); Protection and Enhancement of the Cultural Environment - 1971 (EO 11593); Indian Sacred Sites – 1996 (EO 13007); *Archaeological and Historic Preservation Act* of 1974; *American Indian Religious Freedom Act* of 1978 (PL 95-341); *Antiquities Act* of 1906; *Archaeological Resources Protection Act* of 1979 (PL 96-95); *Native American Graves Protection and Repatriation Act* of 1990 (PL 101-601)
Solid/Hazardous Materials and Waste	*Resource Conservation and Recovery Act* of 1976 (PL 94-5800), as Amended by (PL 100-582); EPA, Subchapter I-Solid Wastes (40 CFR 240-280); *Comprehensive Environmental Response, Compensation, and Liability Act* of 1980 (42 USC 9601) (PL 96-510); *Toxic Substances Control Act* (PL 94-496), EPA, Subchapter R-Toxic Substances Control Act (40 CFR 702-799); *Federal Insecticide, Fungicide, and Rodenticide Control Act* (40 CFR 162-180); *Emergency Planning and Community Right-to-Know Act* (40 CFR 300-399)
Environmental Justice	Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations (EO 12898); Protection of Children from Environmental Health Risks and Safety Risks (EO 13045)

- "Installations that conduct these activities must identify how specific reimbursable program activities directly support mission landscape requirements and environmental stewardship in the *Integrated Natural Resource Management Plan* (INRMP) or other appropriate planning document where INRMPs are not required. Reimbursable program activities that obstruct these requirements are not eligible for automatic reimbursement authority." (Section 2.c.)

- "Agricultural and forest products shall not be given away, abandoned, carelessly destroyed, used to offset contract costs or traded for services, supplies, or products, or otherwise be improperly removed (except as authorized in 3b(9) and 3c(2))." (Section 3.a(1))

1.3 SCOPE OF THE DOCUMENT

The scope of this SEA is the evaluation of the potential environmental impacts of a proposed outlease grazing program on the Fort Hood Military Reservation, in accordance with the guidance and restrictions from the documents above. The contractual- and procurement-related issues and the costs of the proposed action to the DA and Fort Hood are not evaluated as part of this document. Likewise, the impacts of military training are not evaluated in this SEA.

1.4 INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN (INRMP)

In coordination with other agencies and organizations, Fort Hood has drafted an INRMP for the installation, on which the U.S. Fish and Wildlife Service (USFWS) and the TPWD are identified as signatory agencies because of their significant role in the implementation of the INRMP. Numerous other agencies and organizations were identified as partners in development and implementation of the document, including the NRCS (USDA), U.S. Environmental Protection Agency (EPA), State Historic Preservation Officer, Texas State Soil and Water Conservation Board, the Hamilton-Coryell Soil and Water Conservation District, The Nature Conservancy, CTCA, Tarleton State University, and Texas A&M University.

Though the INRMP has been developed, the document has not been signed by the TPWD or the USFWS. Because of this, the INRMP currently is not considered final, however, it is being used by the Army as the current, working version of the document, and the Army is implementing many of the management actions identified in the document within the annual budgetary allocations provided. References to the INRMP throughout this document imply that the management activities discussed are being implemented as described.

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

The proposed action for this SEA remains to be the implementation of a Grazing Outlease Program on Fort Hood. However, the number and complexity of the alternatives to be evaluated in this SEA have been reduced substantially. The alternatives discussed in the original EA are not reevaluated in this supplemental document.

2.1 ALTERNATIVES

Grazing management aspects of the outlease will be consistent among the four grazing alternatives (i.e., stock inventory requirements, annual forage inventories, etc.), and will be described once in this portion of the document. One no action, or no grazing, alternative (Alternative 1) and four grazing alternatives (Alternatives 2 through 5) are evaluated in this SEA.

One critical component of grazing management that will be consistent among the four grazing alternatives is that the number of cattle allowed to graze on the installation will be adjusted annually. These adjustments will be made by the Army, based on forage availability and the stocking rate calculation strategy selected and included in the lease.

Three different approaches or methods for calculating stocking rates were used to develop the four grazing alternatives. The three methods represent different management strategies for maintaining the amount of vegetation (or residue) that should remain on a site after the cattle have grazed. For Alternatives 2, 3, and 4, each of the three stocking rate calculation methods will be used to determine stocking rates annually on all Grazing Management Units.

For Alternative 5, the Preferred Alternative, managers at Fort Hood selected for each Grazing Management Unit the stocking strategy from the previous alternatives that best accommodates grazing and addresses the existing conditions of the land, potential soil erosion, and planned training activities. Descriptions of the calculations are provided in this section of the document, and are presented with the associated data in the *Technical Report* (USACE, 2003).

Several aspects of the Grazing and Lease Management discussed in the previous EA are not addressed in this SEA because they have no bearing on the environmental aspects of the issue and are addressed during negotiation of the lease (i.e., compensation methods and value).

2.1.1 Grazing and Lease Management

The following management requirements and actions will be imposed under all of the grazing alternatives evaluated in this SEA and will be implemented for the duration of the lease. More comprehensive grazing management guidelines will be developed and implemented as part of the next outlease process.

2.1.1.1 Grazing and Herd Management

The installation is divided into eight Grazing Management Units (Figure 2-1) based on geographic configuration, potential barriers to cattle movement between areas, and training uses and associated management restrictions (i.e., Impact Area). Stocking rates for the grazing alternatives are established within each Grazing Management Unit based on the available forage and the vegetation residue strategy for the alternative (described further in Section 2.1.2). The lessee will be responsible for implementing the necessary stocking inventory and herd management practices to ensure the number of cattle present in each Grazing Management Unit does not exceed the stocking rates described in this SEA and established

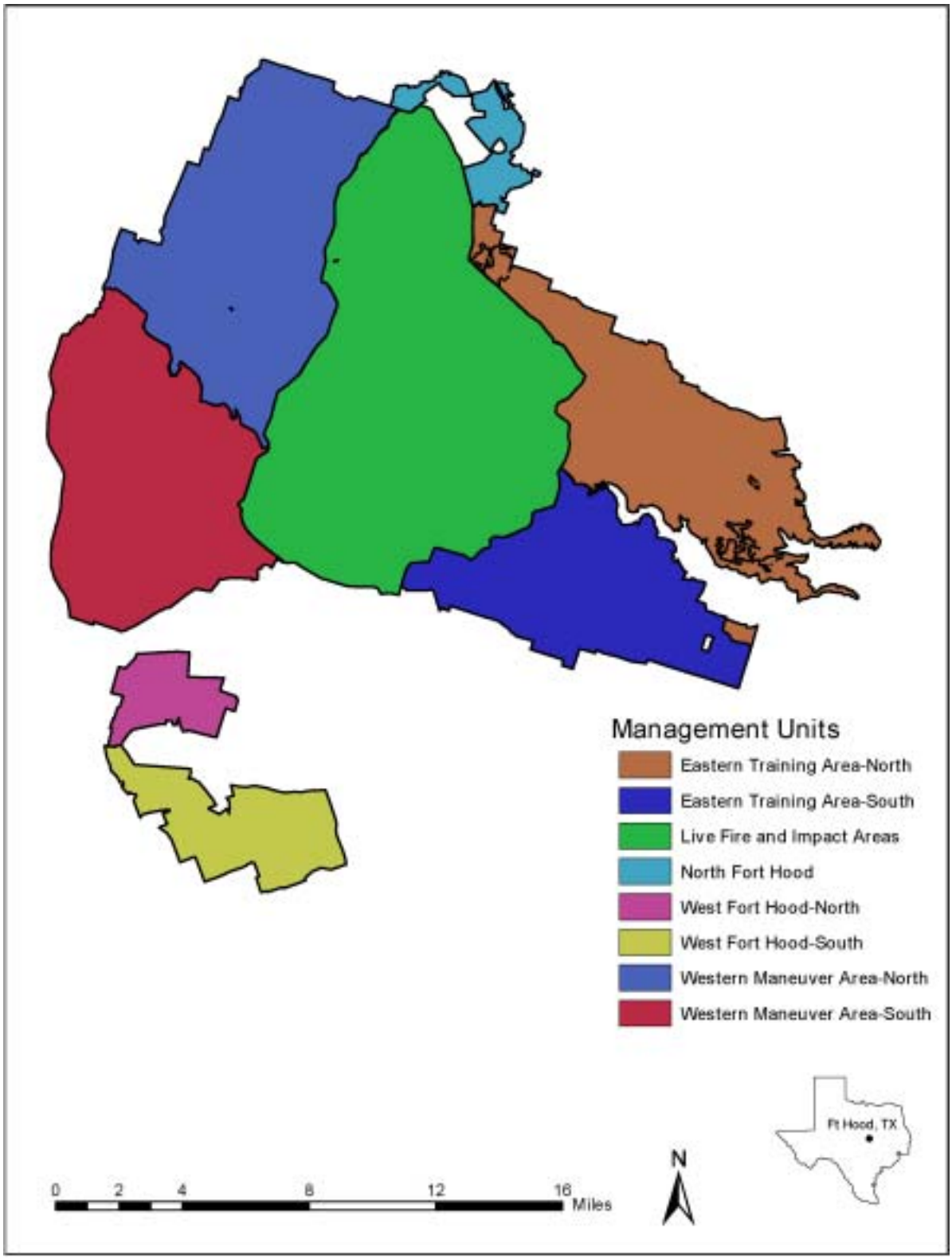

Figure 2-1. Fort Hood Grazing Units.

in the lease. Methods to be used for herd management must be approved by Fort Hood to ensure they do not conflict with the training mission of the installation or are unsafe.

Upon completion of this SEA, and assuming a grazing alternative is selected by the Army, a Notice of Availability for the grazing outlease will be drafted. It is the installation's goal that over the next 2 years, a *Grazing Management Plan* will be developed in coordination with or with input solicited from appropriate individuals and resource agencies. The *Grazing Management Plan* will include additional details on the forage utilization goals for each area based on range condition, land use, and installation goals; herd management and livestock rotation schedules; seasonal use of portions of the Grazing Management Units; livestock inventory accountability and reporting methods; responsibilities of the lessee for facility maintenance; and other issues. This plan will be developed in conjunction with the current working INRMP and other land management plans and directives.

2.1.1.2 Grazing Schedule

Grazing will be year-round where grazing is allowed based on forage availability or potential impacts to environmental resources.

2.1.1.3 Yearly Forage Inventory and Stocking Rate Adjustments

Each year, a contractor hired by the Army, paid for by the lessee, will conduct a forage inventory using standard NRCS methodology to determine the amount of forage likely to be produced during that year in each of the Grazing Management Units, and to assess the ecological health of the areas using the NRCS indices described in the *National Pasture and Range Handbook* (USDA, 1997). The forage inventory data will then be used by the Army to calculate the stocking rate for the Grazing Management Units based on the residue maintenance strategy in the selected alternative as described in Section 2.1.2 below. The Army also will use these data to run the Revised Universal Soil Loss Equation (RUSLE) model to predict the potential soil erosion in the management units (as discussed in Section 4.3), and if erosion is expected to exceed acceptable levels, managers will consider deferring grazing for a year. Additionally, managers will review the ecological health indices and trend analysis to determine if deferring grazing is warranted.

2.1.1.4 Lease Duration

The duration of the lease will be up to 5 years.

2.1.1.5 Cowbird Trapping Program

Cowbird trapping will be continued on the installation under all alternatives described in this SEA. If the current lessee is selected to continue the lease, and an alternative is selected that allows grazing in the areas considered core endangered species habitat, trapping will be continued as described in the MOU related to cowbird trapping on the installation and on adjacent lands. Trapping on the adjacent private land may continue in the absence of an MOU, if the landowners decide to participate in the wildlife management property tax valuation program, but this would be beyond the control of the Army.

2.1.2 Stocking Rates

Stocking rates were established for each alternative using three stocking rate calculation methods that reflected different residue management strategies. The stocking rates presented in this SEA are intended to be used only for the first year of the lease. New stocking rates will be developed based on the new forage inventories described in Section 2.1.1.3. The differences among the calculation methods primarily relate to the amount of forage to be left behind for protection and regeneration of soil (i.e., residue).

Higher amounts of residue are necessary when soil is naturally more erosive or when other land uses have the potential of disturbing the soil.

Potential available forage was calculated by the NRCS in reports generated following the forage inventory conducted in 2002 (NRCS, 2002b). The estimates of available forage in the Grazing Management Units were calculated without accounting for the areas of bare soil within plant communities or areas where grazing is not allowed, therefore available forage was overestimated. Therefore, the potential stocking rates calculated by the NRCS using the standard 25 percent Harvest Efficiency methods led to an overestimation of the stocking rate for the installation.

Fort Hood used satellite imagery and geographic information system (GIS) to identify the amount of bare ground within each Grazing Management Unit in order to properly adjust the potential available forage within each unit. Additionally, areas that are fenced and cows are excluded were identified. The process was fully described in the *Technical Report* (USACE, 2003). After bare ground was classified, exclusion areas identified, and the revised available forage figures were generated, stocking rates were calculated for the management units using formulas representing a range of management strategies. The calculations and assumptions for each set of stocking rates are discussed below. For each set of stocking rate calculations, it was assumed that an animal unit (AU) (i.e., one mature cow of approximately 1,000 pounds and one calf to weaning, usually 6 months of age, or their equivalent) consumes 26 pounds of forage per day, resulting in a yearly forage requirement of 9,490 pounds of forage for each AU.

2.1.2.1 Alternative 1 – No Action Alternative (No Grazing)

Stocking rate across all Grazing Management Units would be zero for the duration of the lease.

2.1.2.2 Alternative 2 – 25 percent Harvest Efficiency

Under this alternative, the standard NRCS method for determining stocking rates was applied to each Grazing Management Unit without regard to potential erosion condition or current land use. The NRCS uses the 25 percent Harvest Efficiency rule as their standard method of calculating stocking rates for private landowners. The 25 percent Harvest Efficiency is considered a conservative method of calculating stocking rate (Hanselka et al., 2002), assuming no other activities are affecting the site. It is based on the premise that, of the forage available on the site, 50 percent of the forage should be left ungrazed to provide cover for the soil and keep the stand healthy (Hanselka et al. 2002). The remaining half is available to the grazing animal; however, approximately half of the remainder (but 25 percent of the total) is lost during the act of grazing by the animal and is returned to the soil as litter, trampled upon or, consumed by insects (White, 1999). Thus, only 25 percent of the forage will be consumed via intake by livestock. However, under this method of calculating a stocking rate, no inherent threshold of forage amount is used to decide when grazing should be deferred. Ecological health indices are used to determine whether conditions are such that an area should be rested. Nor does this method assume other activities in the area, such as military training, will result in the loss of a portion of the forage.

For these calculations, the perennial consumable forage calculated from the May 2002 survey for the ecological sites within the Grazing Management Units was multiplied by the number of acres remaining after bare areas and grazing enclosures were subtracted. This was then multiplied by 0.25 to reflect a 25 percent Harvest Efficiency of forage. This product was divided by the annual forage requirement for an AU (9,490 lbs of forage as described above), which resulted in the total number of AUs for each plant community within a Grazing Management Unit. The AUs were then summed by management units to provide the stocking rates for this management strategy (Table 2-1).

Table 2-1. Approximate Stocking Rates (Animal Unit Years) for Fort Hood Grazing Outlease Alternatives for the Supplemental Environmental Assessment

Grazing Units	Total Acreage	Grazeable Acreage*	Alternatives				
			1 No Grazing	2 25 percent Harvest Efficiency	3 Maintenance Threshold	4 Conservation Threshold	5 Combined (Preferred)
Western Maneuver Area – North	34,961	33,151	0	685	367	255	0
Western Maneuver Area – South	32,305	30,296	0	444	54	14	0
West Fort Hood – North	4,407	4,251	0	203	194	180	203
West Fort Hood – South	10,471	9,855	0	196	128	102	0
Eastern Training Area – North	27,768	27,093	0	249	97	73	0
Eastern Training Area – South	22,678	21,976	0	166	85	74	0
North Fort Hood	3,993	3,843	0	163	147	126	147
Live Fire and Impact Areas	60,887	59,207	0	1,915	1,614	1,465	750**
Total	***197,470***	***189,672***	***0***	***4,021***	***2,686***	***2,289***	***1,100***

* "Grazeable Acreage" excludes those areas within the Total Acreage that were fenced to exclude cattle, relatively large areas of bare ground due to training or construction activities, and therefore are unable to produce forage.

** Maximum stocking rate established by Range Control to minimize training delays due to cattle.

2.1.2.3 Alternative 3 – Maintenance Threshold (750 lb/acre of Ungrazed Forage Residue)

Under this alternative, the Maintenance Threshold approach to calculating stocking rates is applied to all of the Grazing Management Units on the installation without regard to current erosion condition or current land use. Currently, the Texas Cooperative Extension Service states that optimal amounts of ungrazed forage for midgrass sites should range from 750 to 1,000 lbs/acre and 1,200 to 1,500 lbs/acre should for tallgrass sites (Hanselka et al., 2001). Under these amounts of ungrazed forage residue, sites can maintain or improve rangeland health and reduce soil loss due to erosion (Hanselka, 2001). Ungrazed forage residue is important because it provides leaves and stems necessary to regenerate plant material removed during grazing, while at the same time it adds organic matter to the soil to improve soil structure, increases infiltration of water, reduces soil water loss, cools the soil, and reduces erosion (Hanselka et al., 2001). Based on site potential, Fort Hood would be classified as midgrass to tallgrass sites with the majority being midgrass. For this alternative, the objective is to maintain a 750 lbs/acre or greater forage residue in order to maintain rangeland health and reduce erosion. Stocking rates for this strategy were calculated using the same forage production data for the ecological sites as described above. Below is a description of the calculation:

1. Ecological sites producing perennial consumable forage less than 750 lbs/acre were not included in stocking rate calculations since these sites were already below the ungrazed forage residue goal.

2. Stocking rates for sites having less than 1,500 lbs/acre but more than 750 lbs/acre of perennial consumable forage were calculated by subtracting 750 lbs (i.e., the ungrazed forage goal) from

the perennial consumable forage. The remaining forage was multiplied by 0.50, since half of the forage is lost during the act of grazing (see previous discussion above) to get forage available to the animal. Forage available to the animal was then multiplied by the number of grazeable acres. This product was divided by the annual forage requirement for an AU (9,490 lbs of forage as described above), which resulted in the total number of AUs. This calculation allows the residue goal to be maintained and allows forage above the residue goal to be used for grazing.

3. Stocking rates for sites having greater than 1,500 lbs/acre were calculated using the 25 percent Harvest Efficiency. Perennial consumable forage was multiplied by 0.25 to determine forage available for grazing. This was then multiplied by the number of grazeable acres. This product was divided by the annual forage requirement for an AU (9,490 lbs of forage as described above), which resulted in the total number of AUs. This calculation allows the ungrazed forage residue of more than 750 lbs/acre, thus providing further protection for maintaining health and hydrological condition on these sites.

The AUs resulting from the calculations above were then summed by management units to provide the stocking rates for this management strategy (Table 2-1).

2.1.2.4 Alternative 4 – Conservation Threshold (1,000 lb/acre Ungrazed Forage Residue)

Under this alternative, the Conservation Threshold approach to calculating stocking rates is applied to all of the Grazing Management Units on the installation without regard to current erosion condition or current land use. Stocking rates for this strategy were calculated similarly to that described above for the 750 lbs/acre or greater ungrazed forage residue strategy. For this management strategy, the objective would be to maintain a 1,000 lb/acre or greater forage residue in order to promote rangeland health and recovery and to protect the soil from erosion. Therefore, stocking rates for this strategy were calculated as follows:

1. Sites producing perennial consumable forage less than 1,000 lbs/acre were not included in stocking rate calculations since these sites were already below the ungrazed forage goal.

2. Stocking rates for sites having less than 2,000 lbs/acre but more than 1,000 lbs/acre of perennial consumable forage were calculated by subtracting 1,000 lbs (i.e., the ungrazed forage goal) from the perennial consumable forage. The remaining forage was multiplied by 0.50, since half of the forage is lost during the act of grazing (see previous discussion above) to get forage available to the animal. Forage available to the animal was then multiplied by the number of grazeable acres. This product was divided by the annual forage requirement for an AU (9,490 lbs of forage as described above), which resulted in the total number of AUs. This calculation allows the residue goal to be maintained and allows forage above the residue goal to be used for grazing.

3. Stocking rates for sites having greater than 2,000 lbs/acre were calculated using the 25 percent Harvest Efficiency. Perennial consumable forage was multiplied by 0.25 to determine forage available for grazing. This was then multiplied by the number of grazeable acres. This product was divided by the annual forage requirement for an AU (9,490 lbs of forage as described above), which resulted in the total number of AUs. This calculation allows the ungrazed forage residue of more than 1,000 lbs/acre, thus providing further protection for maintaining health and hydrological condition on these productive sites.

The AUs resulting from the calculations above were then summed by management units to provide the stocking rates for this management strategy (Table 2-1).

2.1.2.5 Alternative 5 – Combination, Preferred Alternative

For Alternative 5, the Preferred Alternative, the Army selected the most appropriate stocking rate strategy from those discussed in the previous alternatives for each Grazing Management Unit in order to optimize grazing while taking into consideration available forage, type and frequency of other land uses for the unit, and potential for impacts to ecological health and soil erosion.

Using the stocking rate strategies selected (described below), the Army will use the data collected from the yearly forage inventories to calculate the potential stocking rate for each Grazing Management Unit. The Army will then use the ecological health indices and trend data collected during the inventory to evaluate the condition of the vegetation and soil. The Army will also use the forage inventories and the potential stocking rates to predict the potential for soil erosion in the units using the RUSLE as described in Section 4.3. If the range conditions are poor or declining, or if the soil erosion for an area is greater than the acceptable rate of erosion for the soils in the area, the Army will consider deferring grazing in the unit for the year.

Additionally, the Army imposed upper thresholds for stocking rates based on the potential for impacts to or conflicts with military training. As described in further detail in Section 4.1.1, training activities in these areas are often delayed when cattle wander into the target areas or in the line-of-fire. When cattle enter these areas, training activities are halted (though not required to by the lease agreement), until military personnel can remove the cattle. The Army has determined that grazing more than 750 AUs in this Grazing Management Unit would result in unacceptable delays to the training activities.

The Conservation Threshold approach was determined to be the best calculation method for setting the stocking rate for the Western Maneuver Areas (North and South) because of the heavy training activities in the areas using tracked and wheeled vehicles, and the resulting impacts to vegetation and soil. Leaving the higher volume of forage to protect soil would improve the rate of recovery of the plant community. However, after calculating the potential soil erosion with the remaining forage, it was determined that grazing in this area should be deferred at least one year.

The Maintenance Threshold approach was selected for use in calculating stocking rates for the Eastern Training Area (North and South), North Fort Hood, and the Live Fire and Impact Areas because of the limited amount of training in those areas. However, after calculating the potential soil erosion with the remaining forage in the Eastern Training Area, it was determined that grazing in this area should be deferred at least one year. Also, the Army established a maximum of 750 AUs would be allowed in the Live Fire and Impact Area. As discussed in Section 4.3.5.1, stocking at this rate resulted in a predicted soil erosion rate that was only slightly below the threshold for determining that grazing should be deferred, so any higher stocking rate would have resulted in the Army considering to defer grazing for a year.

The 25 percent Harvest Efficiency approach was selected for use in calculating the stocking rates in West Fort Hood (North and South) because of the lack of training activities in that area. However, after calculating the potential soil erosion with the remaining forage, it was determined that grazing in the southern portion of this area should be deferred at least one year.

2.2 ALTERNATIVES AND TERMS/CONDITIONS CONSIDERED AND ELIMINATED FROM FURTHER ANALYSIS

2.2.1 Full Rotational Grazing

The NRCS produced a Natural Resources Inventory of the installation and provided recommendations for improving the grazing program, including modifications of the grazing intensity, grazing system, and deferments for range recovery efforts, particularly in areas recently cleared of brush using fire or mechanical means (NRCS, 1998). A substantial concern with this alternative is that the full rotational grazing system assumes that access to each of the pastures (in this case, each grazing unit) is controlled and animals can be moved in and out of areas as necessary. Depending on the scale at which the areas are managed, fencing or natural barriers would be required to restrict cattle movement. In typical rangeland and grazing situations, these assumptions and recommendations would be feasible. However, on the installation, few natural barriers sufficiently constrain cattle, and fencing is in direct conflict with the mission, therefore this alternative could not be considered.

2.2.2 North Fort Hood "Restoration Plan"

Preliminary plans have been drafted to implement brush removal and revegetation activities on several training areas within and adjacent to North Fort Hood, and then manage these areas in a rotational grazing system. The objectives of these proposed activities were to improve water quantity and quality in the watershed, enhance herbaceous forage production in the area, and increase the potential stocking rate in the area. The plans identified various land management activities that would be implemented on the areas including chaining or dozing of brush in some areas, cutting brush in areas with potential for excess soil damage or loss, seeding with various pasture grasses, application of fertilizer, irrigation, installation of interior fencing, and rotation of herds among the "pastures" within the North Fort Hood Grazing Management Unit.

However, the preliminary plans did not provide sufficient details to allow thorough evaluation of the potential environmental impacts or training conflicts. Nor was sufficient information available to confirm that the revegetation activities, even if implemented successfully, would generate the amount of forage to support the proposed stocking rates for the area within the timeframes discussed.

Due to the lack of sufficient detailed plans for the *Fort Hood Restoration Plan*, that plan is not included as an alternative in this SEA. If Fort Hood determines that the *Restoration Plan* can be implemented in accordance with land use guidelines for Army installations, a detailed plan must be developed that provides details on revegetation actions to be taken, the fencing locations, the schedule for deferments after soil disturbance, proposed stocking rates for the area, contingency plans in the event the revegetation is not successful, as well as other information deemed necessary by the Army. The potential environmental impacts of this activity will then have to be evaluated in accordance with NEPA.

3.0 AFFECTED ENVIRONMENT

Geographical Setting. Fort Hood is located in central Texas in Bell and Coryell counties. It lies 58 miles north of Austin, 39 miles southwest of Waco, and its northern boundary is 4 miles south of Gatesville, Texas. State Highway 36, which connects Gatesville and Temple, parallels the eastern edge of Fort Hood. The main entrance to the installation is 4 miles west of Killeen on U.S. Highway 190, which runs along the southern portion of the installation (see Figure 1-1 in Section 1).

The military installation encompasses 87,940 ha (217,337 acres). Fort Hood has three cantonment areas, two instrumented airfields, and many maneuver and live-fire training areas. The cantonment areas are primarily for urban uses and are designated the Main Cantonment Area, West Fort Hood (often referred to as South Fort Hood in other documents), and North Fort Hood. The Main Cantonment Area is located at the southern edge of the training area and adjacent to Killeen. West Fort Hood is located south of U.S. Highway 190, near the City of Copperas Cove, and includes the Robert Gray Army Airfield (RGAAF). Occasionally, the Main Cantonment Area and West Fort Hood are collectively referred to as West Fort Hood and includes Hood Army Airfield (HAAF). North Fort Hood, located near Gatesville, is the primary site for Army Reserve and National Guard training and equipment service and storage (USACE, 1999).

Climate. Fort Hood lies along the edge of two climate zones, resulting in highly variable annual and monthly weather patterns, exhibiting characteristics of both the humid subtropical zone to the east and the semi-arid zone to the west. Tropical maritime air masses predominate in the area in late spring, summer and early fall months, while polar air masses are common in winter (USACE, 1999). This combination results in a warm, temperate rainy climate with hot, dry summers.

Temperatures at Fort Hood vary widely within a year, but typically follow a rather simple annual pattern. Winter temperatures reach the mid-thirties regularly, with the coolest temperatures occurring in January, with a 30-year daily average of about 46 degrees Fahrenheit (°F) (7 °Celsius [°C]). Temperatures rise steadily through spring, reaching their highest daily average figures of about 84 °F (29 °C) in late July or early August, with many days reaching at least 90 °F (32 °C) and some reaching at least 100 °F (38 °C). The temperatures then drop steadily and somewhat rapidly throughout the fall months (U.S. Army, 2000).

The long-term average annual rainfall at Fort Hood is about 30 inches, and is highly variable among years, ranging from 19 inches to over 36 inches in the 5-year period of 1998 through 2002 (Table 3-1). Because precipitation typically is the result of thunderstorms, and because of the influence of the two different climatic zones, the spatial and temporal distribution of rainfall is highly erratic, often resulting in periods of drought lasting from 6 to 12 months. The period of maximum rainfall is April and May, often the result of heavy thunderstorm activity and torrential rains. This is followed by a relatively dry period in mid-summer with a second, lesser period of frequent rainfall in September and October. Evaporation and water use by vegetation exceed rainfall from June until September. December and January are normally low in rainfall (USACE, 1999).

The prevailing winds are from southerly directions (south-southwest to southeast). Average wind velocity is relatively low and relatively constant throughout the year. It is typically calm 8 percent to 10 percent of the time in spring and early summer, and 11 percent to 17 percent of the time in fall and winter. Tornadoes may occur in central Texas and are usually associated with severe thunderstorms in late spring through early summer (USACE, 1999).

Table 3-1. Monthly Precipitation Totals from Weather Station on Fort Hood

Month	*1998*	*1999*	*2000*	*2001*	*2002*	*Average*
January	3.66	0.18	2.08	3.16	0.57	1.93
February	4.39	0.04	2.61	1.61	1.73	2.08
March	2.95	3.52	1.37	4.29	2.36	2.90
April	1.62	0.92	3.82	0.88	1.65	1.78
May	1.14	4.75	2.13	5.18	1.88	3.02
June	0.94	4.00	5.35	1.70	4.74	3.35
July	0.39	1.77	0.14	1.17	4.31	1.56
August	3.13	0.00	0.01	6.26	0.03	1.89
September	2.70	0.36	2.29	2.40	3.29	2.21
October	8.14	1.80	5.23	2.24	7.12	4.91
November	3.56	0.19	7.79	4.28	1.48	3.46
December	3.96	1.94	1.92	1.83	4.51	2.83
Total	*36.58*	*19.47*	*34.74*	*35.00*	*33.67*	31.89

Source: Fort Hood Department of Public Works, unpublished data.

Topography and Landforms. Fort Hood is located within the Texas "Hill and Lake Country," with topographic features and landforms characterized by valleys, buttes, and mesas. Fort Hood is near the southeastern edge of the Mid-Continent Plains and Escarpments. Fort Hood is within the region known as the Lampasas Cutplains. The region to the west of Fort Hood is referred to as the Edwards Plateau (USACE, 1992). The USDA Soil Conservation Service (SCS), now the NRCS, has defined land units known as land resource areas. The installation is within the Grand Prairie land resource area. The basic landscape of Fort Hood has been created by upward displacement and subsequent erosion and weathering (over the past 70 million years) of various limestone, shale, and sandstone rock strata (USACE, 1999; USACE, 1992).

The overall land surface forms of Fort Hood have been described as tablelands with moderate relief, or plains with high hills. These landforms contain many escarpments and relatively steep valley sides. The elevation differences between the valley floors and the plateaus, ridges, and hilltops range from 80 to 160 feet (24 to 49 meters). Slopes vary from 3 percent in the floodplains and plateaus to as much as 45 percent on the valley walls. About 5 percent of the installation can be classified as alluvial floodplain. The average slope is between 5 percent and 8 percent (USACE, 1999).

3.1 LAND USE, AIRSPACE USE, AND VISUAL RESOURCES

3.1.1 Land Use

Land use at Fort Hood is allocated primarily to cantonment areas, maneuver/live-fire training areas, and airfields (Table 3-2). The cantonment areas are essentially urban and contain all the administrative, maintenance, housing, logistical, and other installation support land uses. The maneuver/live-fire training areas are the location of the combat training activities, which fulfill Fort Hood's primary purpose. The airfields are located adjacent to the cantonment areas and house the fixed-wing/rotary-wing assets and support facilities (USACE, 1999). Various other land uses located on Fort Hood include the Lake Belton Recreation Area, and miscellaneous uses such as roadways, easements, and cattle grazing.

The Main Cantonment Area is the center of activities at Fort Hood. It houses the administrative operations of III Corps, its subordinate commands, and the Garrison Commander. The Area's most

Table 3-2. Fort Hood Land Use Summary

Primary Land Uses	*Acreage*
Training areas	
Maneuver	133,157
Live-fire	62,000
Cantonment Areas	
Main Cantonment Area (excluding HAAF)	5,862
West Fort Hood (excluding RGAAF)	1,342
North Fort Hood	1,400
Airfields	
HAAF	773
RGAAF	2,142
Belton Lake Recreation Area	862
Miscellaneous uses (roads, easements, etc.)	9,799
Total Acreage	*217,337*

prominent uses are the extensive motor pools along its northern edge that support all of the installation's motorized operations. Also located within the Main Cantonment Area are the majority of the family and single soldier housing as well as social facilities such as mess halls, gymnasiums, stores, daycare, and similar land uses (USACE, 1999).

The U.S. Army uses Fort Hood on a continual basis for military training and preparedness. Appendix A details the land usage by the military for each of the training ranges located on Fort Hood for the period of May 01, 1999, through April 30, 2000. As noted in Appendix A, there are 120 different ranges identified on Fort Hood used by a total of 718,071 personnel during that time period.

West Fort Hood consists of RGAAF, research and administrative facilities for the Operation Testing Command (OTC), support facilities, and housing for military personnel, which accommodates both families and unaccompanied troops. Ammunition is stored west of the airfield in reinforced concrete magazines, most of which are underground (USACE, 1999).

North Fort Hood is the primary site for reserve components and is capable of supporting 12,000 troops in permanent and tent facilities. Land use activities are similar to those of the Main Cantonment Area but are more limited with most activity occurring during summer training. North Fort Hood also includes two auxiliary airfields. When North Fort Hood is not being used for training, fewer than 100 personnel reside there (USACE, 1999).

Over 60 percent of the land (53,889 ha [133,157 acres]) at Fort Hood is used for maneuver training that involves combat, combat support, and combat service support elements integrated into formations to conduct multi-echelon, combined arms training to simulate battlefield conditions. Training includes infantry, mechanized infantry, armored units, artillery and air support with helicopters, fixed-wing tactical aircraft, high-speed interceptors, and large bombers (USACE, 1999).

The live-fire training ranges are in the central section of Fort Hood. The training and evaluation activities include individual, crew-served, and major weapons systems up to battalion strength. Along with units assigned or attached to III Corps, Army Reserve and Army National Guard Units participate in training. The 25,090 -ha (62,000-acre) range area is bordered by East, West, and South Range Roads and contains over 60 different firing range complexes. The firing ranges are oriented so as to have all firing directed at the large impact area (see Figure 2-1). The Area Weapons Scoring System (AWSS) is installed in the

range area for use by armored units and attack aircraft. The AWSS is a sound-based technology used to determine the accuracy of simulated attacks against targets (USACE, 1999).

Training activities in the live-fire and impact training areas are shutdown temporarily for a variety of reasons, including cattle crossing the training ranges. Though not required in the lease agreements, all training activities on the ranges are halted when cattle enter the training ranges and are at risk of injury or death. Table 3-3 presents a summary of the training shutdowns between October 2001 and October 2002, as provided by the Fort Hood Range Control. With each halt lasting at least 30 minutes, the total down time during this period was approximately 250 hours, exclusive of time required to reinitiate the training activities. Additional discussion of the impacts of these delays is included in Section 4.1.

Table 3-3. Training Shutdowns on Range Complexes on Fort Hood

Range	*2001*			*2002*										
Complex	*Oct*	*Nov*	*Dec*	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Total*
# 1	0	8	0	0	0	1	0	3	0	0	0	0	1	*13*
# 2	11	2	2	6	1	3	2	6	0	6	0	2	1	*42*
# 3	4	8	4	3	12	3	0	9	6	11	4	4	20	*88*
# 4	16	7	1	1	4	6	4	4	3	7	8	8	13	*82*
# 5	10	10	3	22	35	33	7	15	24	17	19	34	27	*256*
Total	*41*	*35*	*10*	*32*	*52*	*46*	*13*	*37*	*33*	*41*	*31*	*48*	*62*	*481*

Range Complex # 1Blackwell Multi-Use Range (MUR), Pilot Knob MUR, Clear Creek Small Arms
Range Complex # 2Browns Creek MUR, Cow House Machine Gun
Range Complex # 3Hensen Mountain MUR, Dalton Mountain MUR
Range Complex # 4Lone Star MUR, Crittenberger MUR, Owl Creek Assault Course
Range Complex # 5Brookhaven MUR, Trapnell MUR, Sugarloaf MUR, Black Gap Small Arms

3.1.2 Airspace Use

The HAAF consists of 297 ha (773 acres). HAAF has a control tower and instrument approach procedures. Radar service is provided by the RGAAF radar approach control facility. Two auxiliary airfields, Longhorn and Shorthorn, are also located at North Fort Hood to support flight training (USACE, 1992).

Helicopters assigned to HAAF include the OH-58 Kiowa, AH-64 Apache, UH-60 Blackhawk, and others (UH1 and CH-47) (USACE, 1992). The number of helicopters at HAAF varies with training requirements and other assignments (USACE, 1999).

RGAAF is located on 867 ha (2,142 acres). The airfield supports U.S. Air Force (USAF) and commercial aircraft as part of training and operations exercises for rapid deployment of personnel and equipment. A control tower, a radar approach control facility, and instrument approach procedures serve RGAAF. There is an airport traffic area for tower-controlled traffic patterns, an approach control for radar services to and from the airfield, and a control zone for aircraft on instrument arrival and departure routes (USACE, 1999).

3.1.3 Visual Resources

The natural environment, in its undisturbed state, is visually attractive. The landforms–flat-topped steep-sided plateaus, ridges and isolated hills, sloping valley sides, floodplains, and stream courses–are varied and visually interesting. Rock outcrops are visible at the tops of some of the steeper slopes and add visual interest. Vegetation is visually varied with dense shrub forest, areas of scattered trees and brush, and

areas with low grassy or forb ground cover. Trees are a mix of coniferous and deciduous species. Moving or standing water along stream channels or in the form of constructed ponds and small lakes is frequent and also adds visual interest (USACE, 1999).

The training areas occupy the bulk of the installation. They are primarily natural but include isolated facilities and equipment used for range operations. Cattle grazing occurs throughout the installation, primarily in the open grassy areas. Some portions of the range are marred by vehicle tracks and ruts from field training activities (USACE, 1992).

The Main Cantonment Area is built on gently rolling terraces (USACE, 1999). Buildings vary in size and style, reflecting continuous development from the 1940s to the present with most structures being one or two stories in height. The buildings in the Main Cantonment Area are separated by large, open, grassy areas used for recreation and as parade grounds and by parking and undeveloped areas. Several family housing areas are interspersed throughout the Main Cantonment Area. The older housing areas have more established landscaping (USACE, 1992). The community of Killeen is immediately adjacent to the installation and not far from the Main Cantonment Area.

The visual appearance of the Main Cantonment Area relates directly to its functions and date of construction. The Main Cantonment Area is characterized by large, open spaces with little landscaping outside of the family housing areas. The headquarters buildings are sited to maximize the impact of large monumental forms in the middle of an open space. Because of low building density, Fort Hood is automobile-oriented. Most buildings have small to large parking areas beside them, which generally lack landscaping and shade (USACE, 1992).

North Fort Hood, at the opposite side of the installation from the Main Cantonment Area, is smaller in scale but generally similar in appearance. It has large, open areas used for tents during reserve training in the summer. A third major built-up area of the installation is West Fort Hood, located southwest of the Main Cantonment Area. This is built around RGAAF and various research and testing facilities. It is visually separated from the main post by the surrounding landscape. West Fort Hood is focused on RGAAF with its extensive open spaces and large industrial buildings. Its lack of landscaping contributes to a relatively barren visual character (USACE, 1999).

The Belton Lake Outdoor Recreation Area is operated by Fort Hood. The area's varied topography, mature vegetation, vista points, lakeside beaches, and amenities contrast with the more organized and developed areas on the installation. The well-maintained roads and facilities are generally smaller in scale than in the Main Cantonment Area (USACE, 1992). A visually intrusive condition has been caused by a lack of designated parking. This has caused degradation of the natural environment as visitors consequently drive and park off the road (USACE, 1999).

There are no scenic highways of visually sensitive, federally protected areas that have views to Fort Hood. Mother Neff State Park, northeast of the installation, has no line-of-sight to the Main Cantonment Area. Vista points in Belton Lake Recreation Area have views to Killeen and the installation. Stillhouse Hollow Lake, south of Killeen, has no views to any portion of Fort Hood where new construction would occur (USACE, 1992).

3.2 BIOLOGICAL RESOURCES

3.2.1 Flora

The combination of soils, topography, climate, and human activities has produced a diverse mix of vegetation communities or habitats within the installation. Fort Hood is in the southernmost extension of the Cross Timbers and Prairies region and the northwestern reaches of the Edwards Plateau ecological region. The woodlands in the area are most closely representative of Edwards Plateau vegetative associations. The grasslands, which comprised much of the area historically, are representative primarily of the mid-grass associations of the Cross Timbers and Prairies areas, with inclusions of the tall-grass associations of the Blackland Prairie. Frequent range fires throughout the grasslands confined the woody vegetation to the riparian areas and the rocky slopes and hills. As a result of human activities, including grazing, reduction and suppression of fires, and training activities, the current vegetation structure and mix of species differ from those expected for these vegetation communities (NRCS, 1998).

Grasslands are found throughout the installation, but are most common in the live-fire zone/impact area and in the Western Maneuver Area (Figure 3-1). Wildfires caused by various training activities in these areas likely reduce the woody vegetation in the areas. Grassland areas are composed primarily of perennial herbaceous species, and may include little bluestem (*Schizachyrium scoparium*), hairy grama (*Bouteloua hirsuta*), sideoats grama (*Bouteloua curtipendula*), Texas wintergrass (*Nassella leucotricha*), blue grama (*Bouteloua gracilis*), seep muhly (*Muhlenbergia reverchonii*), silver bluestem (*Bothriochloa saccharoides*), prairie-tea (*Croton monanthogynus*), broomweeds (*Amphiachyris* sp.), ragweed (*Ambrosia artemisiifolia*), three-awn (*Aristida* sp.), and snow-on-the-prairie (*Euphorbia bicolor*). Small, isolated areas have a species composition that is more representative of the tall-grass prairies, which are dominated by little bluestem, yellow Indiangrass (*Sorghastrum nutans*), and big bluestem (*Andropogon gerardii*) (USACE, 1999).

The Forest and Shrub Communities are a major component of the installation (Figure 3-1). The majority of these communities are found on the rocky slopes and hillsides or mesas, with a lesser amount of woodlands occurring in narrow bands along streams; however, these areas have increased in their prevalence on the installation with the suppression of fire, increased disturbance, and continuous grazing by livestock. Three distinct communities have been classified in this area: Coniferous Forest and Shrub, Deciduous Forest and Shrub, and Mixed Forest and Shrub communities. Small pockets of Coniferous Forest and Shrub Communities are found throughout the installation and are primarily composed of Ashe juniper (*Juniperus ashei*; commonly referred to as "cedar"), the only coniferous species in the area. Other species found in this community include flameleaf sumac (*Rhus lanceolata*), Texas ash (*Fraxinus texensis*), plateau live oak (*Quercus fusiformis*), a variety of grasses, and broomweeds (*Amphiachyris* sp.). Another relatively uncommon vegetation association throughout the installation is the Deciduous Forest and Shrub Community. This community is composed of broad-leaf trees and shrubs and is found in lowlands and on protected slopes. Tree species representative of this community include plateau live oak, post oak (*Quercus stellata*), pecan (*Carya illinoiensis*), and sycamore (*Platanus occidentalis*). Understory species include supple-jack (*Berchemia scandens*), common buttonbush (*Cephalanthus occidentalis*), Texas persimmon (*Diospyrus texana*), saw greenbriar (*Smilax bona-nox*), hairy grama (*Bouteloua hirsuta*), Texas grama (*Bouteloua rigidiseta*), prairie-tea (*Croton monanthogynus*), broomweed, silver bluestem, prairie three-awn (*Aristida oligantha*), and mist-flower (*Eupatorium coelestinum*). The most common vegetation community on the installation is the Mixed Forest and Shrub Community. In some areas Ashe juniper dominates over either plateau live oak or Texas oak, and in others the oaks dominate the Ashe juniper. Understory species are a combination of the species found in the other two communities (USACE, 2000; USACE, 1999).

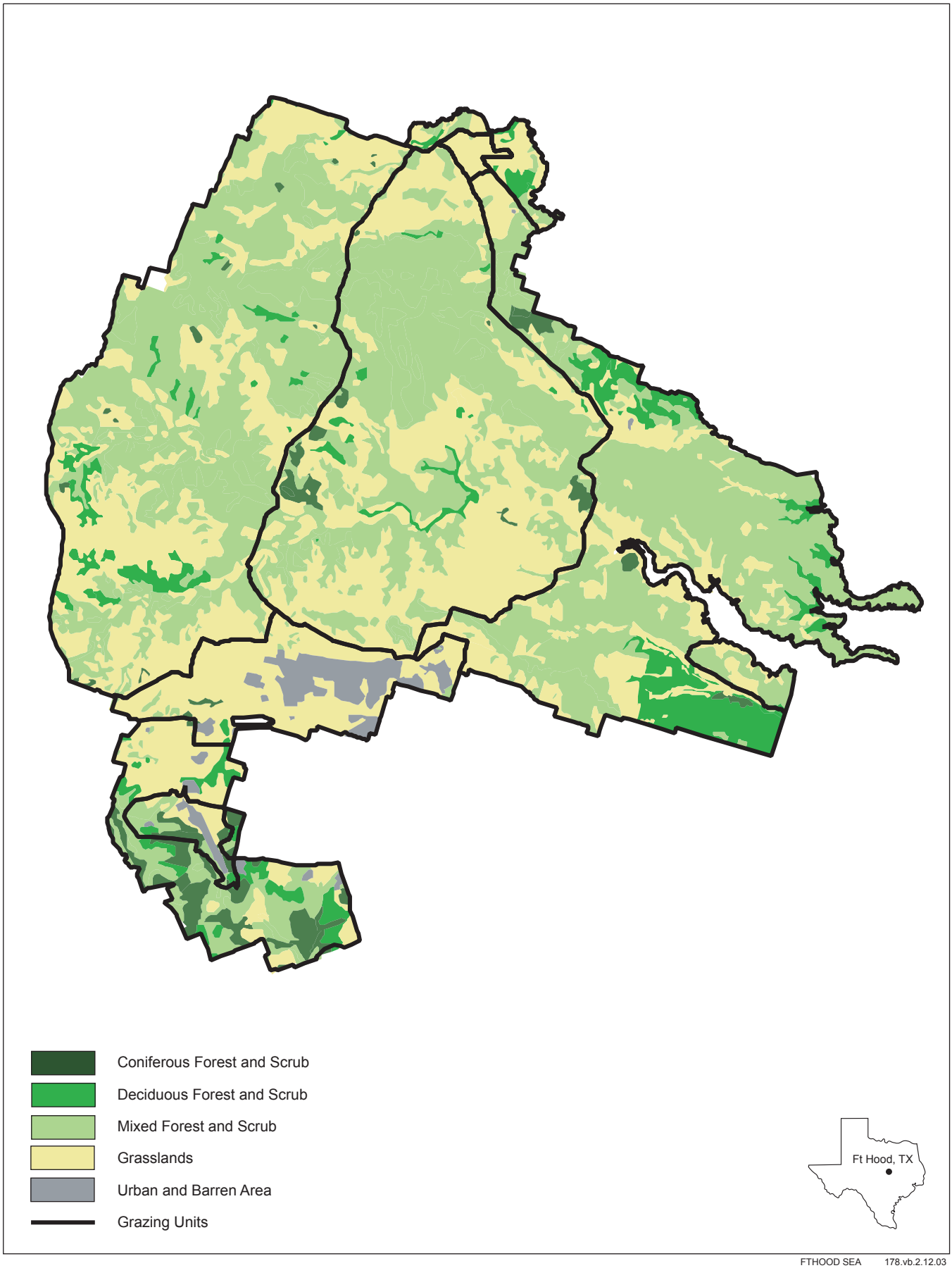

Figure 3-1. Fort Hood Vegetation.

Over time, training activities, extensive continuous utilization by livestock, and suppression of wild fires have substantially altered the vegetative community on the installation. Military training activities, especially those by tracked and wheeled vehicles, have disturbed or successfully eliminated many of the robust perennial plant species in open areas. Military training has also led to disruption of the soil surface and soil compaction, especially when the activities have occurred during wet periods (NRCS, 1998). Disruptions to the plant community after military training are further exacerbated by livestock grazing during and after these training activities. Livestock have a tendency to graze the new shoots of the perennial herbaceous species that attempt to re-establish after soil disturbance. Grazing immediately after training disturbances, or other disturbances such as brush removal, does not allow the vegetation to have the proper rest needed to fully recuperate and gain vigor. Because of the lack of interior fencing on the installation (fencing conflicts with mission activities), livestock access to areas disturbed by military training or areas that have been revegetated are currently not restricted from grazing. The lack of grazing deferral after soil disturbance has subsequently led to a decline in the abundance of perennial grass species and has promoted the invasion of short-lived annual plants that have less extensive root systems, thus making the soil less resistant to erosion (NRCS, 1998).

Additionally, military activities in combination with livestock grazing have reduced the presence of the fine fuels required to carry the range fires. Fires that became established were suppressed due to potential impacts to structures and the risk to human life. With the suppression of the fires, and the loss of competitive grasses due to military training and livestock grazing, Ashe juniper and other woody vegetation of the rocky slopes encroached into the grasslands, forming dense thickets in many areas, reducing forage production for livestock and wildlife (NRCS, 1998). Lack of fire and over-utilization by livestock have been found to be primary factors leading to Ashe juniper and other woody plant increases in the Edwards Plateau (Smeins et al., 1997). Prior to the 1990s, Fort Hood had an aggressive prescribed burning and juniper removal program. With the cessation of the program after 1990, Ashe juniper has spread uncontrolled (NRCS, 1998).

To assist Fort Hood in developing the INRMP, the NRCS conducted a vegetative resource inventory in 1997 for the purpose of determining the ecological health and to establish recommended livestock carrying capacities for the Fort Hood vegetation (NRCS, 1998). The NRCS report stated the following about the condition of the vegetation resources for grazing in 1997:

- Excessive military training and livestock grazing on open, flatter topography has led to increased erosion, decreased plant cover, and lower ecological condition.

- Eighty percent of all the eastern and western training areas have low (<25 percent) similarity indices (i.e., the present plant community is less than 25 percent similar to that of the historic, climax vegetation for the site).

- Intensive training with tracked vehicles, coupled with intensive and continuous grazing destroys the perennial vegetation and promotes invasion of annual plants and native woody species such as juniper.

- Areas having a lack of military activity and a lack of grazing for 20 years had similarity indices that were approximately 25 percent indicating that rest from military activities and grazing did not necessarily improve site condition and may have caused degradation of the plant community. This provides evidence that permanent deferment from military training and livestock grazing is not a solution for improving ecological health.

- South Fort Hood (West Fort Hood designation in this document) had the highest ecological condition due to 3 to 5 years of grazing deferment, conservative stocking rates, and less military training.

- The Live Fire Area was in good to excellent ecological condition because of the high frequency of burning and light grazing.

- Stocking rates were too high on a majority of the installation and distribution of animals needed improvement.

- Stocking rates for years previous to the inventory most likely far exceeded the contractual agreement.

- Grazing and training deferments are necessary on all areas void of dense vegetative cover.

In 2001, the NRCS conducted an inventory in the Western Maneuver Area, the Eastern Training Area and West Fort Hood to estimate soil erosion and determine rangeland health and trend. Sampling was conducted at permanent vegetation monitoring points that had been established for the data gathered in 1997. This allowed comparisons to be made between years (1997 and 2001) for rangeland productivity, erosion, and rangeland health and trend. The results indicated that productivity of grazeable perennial species declined 55 percent on average in the West Fort Hood management units, 46 percent in the Eastern Training Area, and 76 percent in the Western Maneuver Area. Rangeland health was also monitored. Rangeland health is defined as the degree to which the integrity of the soil, the vegetation, the water, and the air as well as the ecological processes of the rangeland ecosystem is balanced and sustained. Integrity is defined as maintenance of the structure and functional attributes characteristic of a particular locale, including normal variability (USDA, 1997). Rangeland health was found to be declining at the majority of the sites sampled in the Eastern Training Area and the Western Maneuver Area. In the Western Maneuver Area, only 4 percent of the sites (1 out of 25 sampled) exhibited soil, vegetation, and watershed (i.e. rangeland health) attributes that were functioning properly (NRCS, 2002a). In the Eastern Training Area, 29 percent (4 out of 14 sampled) of the sites exhibited soil, vegetation and watershed attributes that were functioning properly. The remainder of the sites exhibited attributes that would be categorized by their rangeland health as "at risk" or "not functioning" (NRCS, 2002a). West Fort Hood was found to have the best rangeland health conditions with approximately 60 percent of the sites monitored exhibiting stable health (NRCS, 2002a).

Rangeland trend was also assessed in the 2001 survey. Rangeland trend is a rating of the direction of change that may be occurring on a site. Trend defines whether the plant community and the associated components of the ecosystem are moving toward or away from the historic climax plant community or some other desired plant community or vegetation state (USDA, 1997). In the Western Maneuver Areas, both short- and long-term rangeland trend was found to be declining on the majority of the sites. In the Eastern Training Area, approximately half of the sites had downward trend (NRCS, 2002a). At West Fort Hood, the majority of sites exhibited an upward trend.

The primary conclusions of the 2001 rangeland health inventory was that declining rangeland health and trend on portions of the installation were the result of increased military training, continuous grazing of livestock without deferment, and the effects of multi-year droughts. The NRCS recommended that livestock and training deferments were needed in much of the Western Maneuver Area and portions of the Eastern Training Area to allow perennial vegetation to increase root biomass and recover (NRCS, 2002a)

A vegetation resource inventory similar to the one conducted in 1997 was conducted in May 2002. The primary objective of this inventory was to determine the amount of grazeable forage on the installation and to document the species composition (USACE, 2003), in order to develop stocking rates used in this SEA. Results of this inventory indicated that perennial forage that could be grazed by cattle was low (<750 lbs/ac) relative to site potential in the majority of the ecological sites in the Eastern Training Area

and in the southern portion of the Western Maneuver Area. In the Eastern Training area, sites that had moderate to high productivity (1,000 to 3,000 lbs/ac) were generally dominated by King Ranch bluestem (*Bothriochloa ischaemum*), a non-native perennial grass that has high productivity but has only fair grazing value (NOTE: a plant with "Fair" grazing value has less volume production, lower palatability, and lower quality in that area compared to plants with "Good" value). In the North Fort Hood management unit, Texas wintergrass (*Stipa leucotricha)* and Virginia wildrye (*Elymus virginicus*), both native cool season species, comprised approximately 60 percent of the grazeable forage, thus making this area a candidate for seasonal grazing. In the West Fort Hood management units, grazeable forage was generally greater than that of other management units and the sites were dominated by little bluestem (*Schizachyrium scoparium*). The unique characteristics of the various grazing management units play an important role in optimizing livestock production with minimal impacts on the resources, and these issues will be summarized and addressed during development of the *Grazing Management Plan*.

3.2.2 Fauna

The various habitat types in the area provide for wildlife communities characteristic of the Edwards Plateau, Blackland Prairie, and the Cross Timbers and Prairies areas. Terrestrial wildlife habitats closely follow the vegetation communities described above, but also follow clines from upland down to riparian habitats.

Deciduous woodland in riparian areas contains the greatest densities of passerine birds, followed by juniper woodland and mixed woodland. The least dense bird populations are found in the grassland habitat. The most widespread and abundant passerine species located on the area is the cardinal (*Cardinalis cardinalis*), which thrives in disturbed areas. Other common species are the mourning dove (*Zenaida macroura*), Carolina chickadee (*Parus carolinensis*), mockingbird (*Mimus polyglottos*), and turkey vulture (*Cathartes aura*). Common mammal species in the area are the raccoon (*Procyon lotor*), white-tailed deer (*Odocoileus virginianus*), and black-tailed jackrabbit (*Lepus californicus*). Common small mammals include the deer mouse (*Peromyscus maniculatus*), hispid cotton rat (*Sigmodon hispidus*), and eastern wood rat (*Neotoma floridana*). Reptiles and amphibians at Fort Hood are representative of the eastern, western, and southern U.S. communities. Eastern species present on the installation include Blanchard's cricket frog (*Acris crepitans blanchardi*), gray treefrog (*Hyla versicolor*), and bullfrog (*Rana catesbeiana*). Western species include the Texas greater earless lizard (*Cophosaurus texanus*), collared lizard (*Crotaphytus collaris*), western diamondback rattlesnake (*Crotalus atrox*), and the western narrow-mouthed toad (*Gastrophryne olivacea*). Southern species include the Texas spiny lizard (*Sceloporus olivaceus*), short-lined skink (*Eumeces tetragrammus brevilineatus*), Rio Grande leopard frog (*Rana berlandieri*), and Texas patchnose snake (*Salvadora grahamiae lineata*). Thirty-two species of fishes have been documented from the lakes, ponds, and streams on the installation. The common species are the red shiner (*Cyprinella lutrensis*), the blacktailed shiner (*Notropis venustus*), and the bullhead minnow (*Pimephales vigilax*), with the remaining species being members of the minnow (Cyprinidae) or sunfish (Centrarchidae) families. The only group of species expected to occur but not found on the installation is the darters (*Percina* sp.), likely due to impacts of sedimentation of the gravel habitat required by these species (USACE, 1999).

Wild game populations appear stable although some species number less than the expected carrying capacity. The white-tailed deer is the most important big-game mammal in Texas, and is managed as a recreational resource. The ideal carrying capacity of white-tailed deer for Fort Hood's habitat is estimated at one deer per 50 acres, but surveys indicate that the density is approximately one deer per 81 acres. Wild turkey appear to be gradually increasing in abundance although the observed gain may be biased by improved survey techniques (USACE, 1999).

Accurate information is not available for recent trends in small game populations, but casual observation indicates healthy numbers of the most consistently hunted species such as dove, quail, rabbits, and

squirrels. Winter waterfowl populations remain consistently low and erratic due to lack of suitable habitat and distance from the major routes of the Central Flyway. Native game fish such as channel catfish (*Ictalurus punctatus*) and largemouth bass (*Micropterus salmoides*) are increasing in population due to intensified management practices on selected lakes, but much of the gain is moderated by a proportionate increase in fishing pressure (U.S. Army, 2000).

Wetland habitat is limited, but where it does occur, aquatic wildlife is typical of the particular habitat. Moving or standing water along stream channels or in the form of constructed ponds also provide habitats for plants and wildlife. Largemouth bass and channel catfish are important recreational species and both are supplemented by stocking in many of the impoundments. Fort Hood also stocks nonnative rainbow trout (*Oncorhynchus mykiss*) in the winter months of each year, but this exotic species is fished out by spring and those fish that survive the fishing succumb to the summer heat (USACE, 2000).

3.2.3 Threatened and Endangered Species

Presently, three species found on or near Fort Hood are listed as threatened or endangered species under the *Endangered Species Act*. The bald eagle (*Haliaeetus leucocephalus*) is a winter resident on Belton Reservoir, on the east boundary of the installation, and flies over and feeds on the installation during the winter. The golden-cheeked warbler (*Dendroica chrysoparia*), which was federally listed as endangered in December 1990, nests on Fort Hood during March through June. The black-capped vireo (*Vireo atricapillus*) was listed as endangered in November 1987 and nests on Fort Hood from March through July each year. Additional information is provided on these species later in this section.

Whooping cranes (*Grus americana*), a federally listed endangered species, are rare migrants through the Fort Hood area. Five observations of whooping cranes on the installation were documented in December 1986. They may fly over the installation during spring and fall migration and may stop on Belton Lake (USFWS, 2000).

In addition to the listed species, formerly listed species, species of special concern, and species protected by the state have been observed on the installation. The peregrine falcon (*Falco peregrinus*), removed from the threatened species status in 1999, has been observed in the vicinity, but do not nest on the installation. It is presumed that the species is a rare migrant through the area (USFWS, 2000).

The Texabama croton (*Croton alabamensis* var. *texensis*), a species of concern that was formerly a Category 2 candidate species under the *Endangered Species Act*, is only known from several locations in Texas, including a few locations in the Eastern Training Area, another location in Coryell County, and one location in Travis County. A closely related variety of the species occurs in Alabama. The true distribution of the species in Texas is unknown. Habitat loss due to development is likely the primary threat to this species. Threats to the species are unknown because the species is relatively unknown (USACE, 2000).

Several endemic and currently undescribed cave invertebrate species and one undescribed salamander (*Plethodon* sp.) occur in the Karst systems beneath Fort Hood. Studies are ongoing to confirm the taxonomic status of these organisms (USACE, 2000; USFWS, 2000). These Karst features are associated with the groundwater system that is the source of spring waters and are protected from public and military activities.

Six observations of the Texas horned lizard (*Phrynosoma cornutum*), a species listed as Threatened by the State of Texas, have been documented in the western portion of the installation (The Nature Conservancy of Texas, 1999; USACE, 2000). The species prefers arid to semi-arid habitats with minimal vegetation. Specific threats to this species on Fort Hood have not been identified. No legal requirement exists to

study or manage the species; however, a literature review and feasibility study are currently underway to determine whether a status survey may be conducted in-house or with minimal outside funding (Horne, 1999).

Golden-cheeked Warblers. The golden-cheeked warbler is found only in Texas and has been recorded in 41 of the 254 counties in the state, but currently may occur in only 31 counties (USACE, 2000). Golden-cheeked warblers nest in mixed oak-juniper woodland, preferring older stands with tall, old (approximately 40 years old) trees and closed canopies (USFWS, 1992). Golden-cheeked warblers nest in suitable habitat throughout the installation (Figure 3-2). The Fort Hood *Endangered Species Management Plan* (ESMP) designates 14,879 ha (36,766 acres) of golden-cheeked warbler habitat in the Eastern Training Area as core habitat for the species, and activities in the core habitat area are tightly restricted to minimize impacts to the species (USACE, 2000). Based on the most recent monitoring efforts, the golden-cheeked warbler population size on Fort Hood increased significantly over the past 10 years (Anders, 2001).

Across the range of the species, threats include habitat destruction by urban development, brush clearing, oak wilt, range wildfires, and nest parasitism from brown-headed cowbirds (*Molothrus ater*). Development and related brush clearing are minimal concerns on the installation because installation guidelines restrict brush removal within 100 meters (328 feet) of endangered species habitat (USACE, 2000). Oak wilt has been observed on the installation and its impacts are unknown, but studies are underway to assess the extent and the impacts of this disease. Wildfires on the installation result from training activities, primarily in the live-fire and impact areas, during hot and dry periods when fuel is readily available in the form of dry brush and/or grass. Such fires have affected both golden-cheeked warbler habitat and that of the black-capped vireo over the past decade.

Cowbird parasitism (i.e., cowbird lays egg in nest of a host species) has been a substantial concern for managers on the installation, as well as throughout the range of the species (USFWS, 1992). Cowbirds are most abundant near grazing cattle, where the birds feed on insects disturbed by the cattle, but cowbirds are known to travel up to 13 kilometers (km) (5 miles) to do so. Most species parasitized by the cowbird are unable to differentiate between their hatchling and the cowbird hatchling, and expend energy and other resources raising only the cowbird. However, the golden-cheeked warbler is one of the few species that will either abandon parasitized nests, or successfully raise the cowbird hatchling with a reduced number of its own, reducing but not eliminating the impacts of cowbirds on the species. Cowbird parasitism on golden-cheeked warbler nests occurs throughout the installation, however the actual rate of parasitism is unknown due to the difficulty in monitoring the nests of this species (USACE, 2000).

Black-capped Vireos. The current northern extent of the breeding range of the black-capped vireo is southern Oklahoma, with observations of the species in 40 counties in Texas and into Mexico. Black-capped vireos arrive on the nesting grounds during late March. They frequently raise a second brood after the first brood has fledged, and continue active nesting until late July. Most birds are gone by late August, although a few may be found well into September (USACE, 2000).

Black-capped vireos nest in an early-successional deciduous scrub community. This habitat is generated as the result of various disturbances, including wildfire or mechanical removal of woody top growth. Good nesting habitat for black-capped vireos includes a wide diversity of hardwoods in a patchy, low-growing configuration with open, grassy spaces between patches of woody vegetation. Managing habitat for black-capped vireos requires active management, as habitat will decrease in quality as it ages, until it is no longer used. Black-capped vireos are found nesting in suitable habitat throughout the installation.

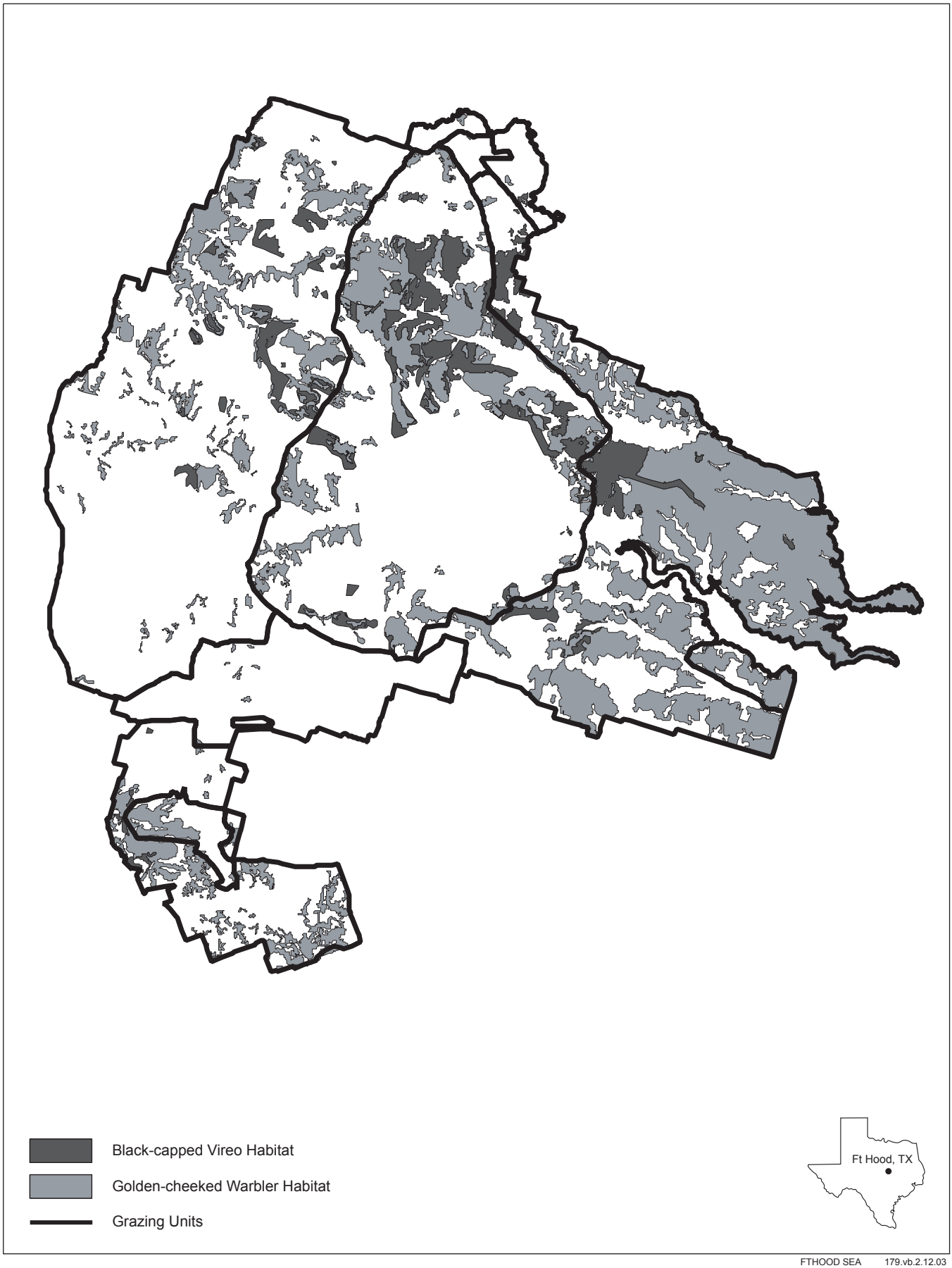

Figure 3-2. Generalized Locations of Current Endangered Species Habitat.

The Fort Hood ESMP designates 4,184 ha (10,340 acres) of black-capped vireo habitat in the Eastern Training Area as core habitat for the species. Activities in the core habitat are tightly restricted to minimize the risk of impacts to the species (USACE, 2000).

Throughout the range of the species, the black-capped vireo is threatened by cowbird parasitism, and by habitat loss from browsing animals (goats, deer, and exotics), fire suppression, and urban development. Wildfire suppression threatens the black-capped vireo because it utilizes the relatively young mixed shrub communities that replace the older, single-species juniper stands after a wild fire (USFWS, 1991). In 1999, black-capped vireos were observed in the areas burned in the wild fires in 1996 described above (USFWS, 2000).

Cowbird parasitism on the black-capped vireo is a greater concern than on the golden-cheeked warbler because the vireo does not have a natural defense mechanism such as nest abandonment. Some studies show parasitism rates to be as high as 60 to 70 percent (USACE, 2000). On Fort Hood, during 1987 and 1988, parasitism rates were about 90 percent, with nesting success at only 5 percent (USACE, 2000). During 1993 to 1995, nest parasitism declined to 15 to 28 percent, and nesting success increased to 32 to 57 percent, as a result of an intense cowbird trapping and shooting program initiated in 1988 (The Nature Conservancy of Texas, 1999). In 1999, parasitism rates on black-capped vireos ranged from 0 to 12 percent in areas with intensive cowbird trapping programs, and as high as 32 percent for an overall rate of 13 percent (Koloszar and Bailey, 1999). In 2000, the parasitism rate for the installation had dropped to less than 6 percent, with the highest prevalence of parasitism being 19 percent in the West Fort Hood training area (Koloszar and Becker, 2000). During 2001, parasitism rates on vireos were 5.3 percent in all regions combined, and 9.8 percent (n = 81 nests) in "core" vireo habitat (DeBoer and Koloszar 2001). These reductions in parasitism rates are likely the result of the success of intensive cowbird trapping programs on the installation, trapping efforts on adjacent private lands conducted under the MOU with the CTCA (Summers et al., 2000), and other private land trapping conducted under a state-wide wildlife management tax valuation program.

Bald Eagle. Bald eagles winter regularly on Belton Lake and the shoreline along the eastern boundary of Fort Hood. Wintering populations vary from two to as many as seven, including adults, subadults, and juveniles. Eagles arrive during mid- to late-October, and depart generally around the end of March. Historically, threats to bald eagles included hunting, habitat destruction, and widespread pesticide use. Laws preventing hunting of the species and outlawing the use of certain pesticides have resulted in a significant comeback by this species, and a proposal to remove it from the threatened species list. The only substantial threat to this species on the installation is the aerial support for training activities. However, activities near roost sites are heavily restricted when bald eagles are known to be in the area (USACE, 2000; USFWS, 2000).

Cowbird Trapping. As discussed above, nest parasitism by the brown-headed cowbirds is one of the major threats to endangered birds on the installation. To minimize the impact of cowbird parasitism on the endangered golden-cheeked warbler and the black-capped vireo, the NRMB has implemented a substantial cowbird trapping and shooting program on the installation since 1988. Parasitism rates have fallen and abundance of golden-cheeked and black-capped vireos have increased over that period (Hayden et al., 2000). Trapping on Fort Hood is conducted primarily during the nesting season of the vireo and warbler, with the number of traps in operation varying throughout the year. During the breeding season (March to June), 32 or 33 traps were in operation per month. During the remainder of the year, 20 to 28 traps were in operation per month. Traps are located in areas in which concentrations of cowbirds were likely to occur (Summers et al., 2000; USACE, 2000).

To further reduce parasitism rates on the warblers and vireos in the core habitat areas, NRMB considered restricting cattle grazing in those areas during the nesting season. An MOU was developed that allowed

grazing in these areas to continue if the CTCA supported an off-site cowbird trapping program (USFWS, 1999). Under the MOU, the CTCA provides financial support for a government employee for trapping during the breeding season, maintains the 27 traps, and works with TPWD to gain voluntary legal access to the private lands adjacent to the installation in the targeted areas (USFWS, 1999).

The cooperation between the CTCA, Fort Hood, TPWD, USDA Wildlife Services, the USFWS, and others, resulted in a program that has reduced the impacts of the cowbird on the endangered bird species (as well as the non-endangered species) in the area, and allowed continued grazing in areas considered to be core habitat for the species. This program on Fort Hood has resulted in numerous recognitions for many of the organizations and individuals involved.

In 1995 Texas voters approved Proposition 11 amending Article VIII, Section 1-d-1 of the Texas Constitution to permit agricultural appraisal for land used to manage wildlife. The State Comptroller, with the assistance of TPWD and the Texas Agriculture Experiment Station, developed guidelines and requirements for these lands to qualify for agricultural appraisal. Based partially on the success that cowbird trapping on the installation has had in conserving the warbler and vireo, cowbird trapping is included as a qualifying management action for this program in areas considered habitat for the golden-cheeked warbler and the black-capped vireo (TPWD, undated). The TPWD established additional guidelines for trap design and trapping protocol for the trapping program, and over 400 traps were operational in the region as of January of 2003 (Terry Turney, Personal Communications, 14 January 2003).

Despite the effectiveness of the cowbird program on the installation, and the perceived connection between the Fort Hood Program and the agricultural appraisal program, these programs are in no way dependent on each other. If the Army determines that grazing must be deferred from the core endangered bird habitat to minimize impacts on soil, water, or other resources, thus nullifying the MOU, cowbird trapping will continue to be part of the statewide appraisal program.

Consultation History. Fort Hood conducted formal consultation with the USFWS during 1992 and 1993 concerning the military mission and associated land uses. A nonjeopardy *Biological Opinion* was issued in late 1993, which stipulated various research and management actions necessary to mitigate expected incidental take. A wildfire occurred in 1996 that exceeded acceptable incidental take allowances for black-capped vireo and golden-cheeked warbler habitat. During the formal consultations that resulted, the Army drafted an ESMP, finalizing the document in early 2000. The USFWS issued a *Final Biological Opinion* that included incidental take allowances and called for implementation of the ESMP and continuation of monitoring and management activities to promote recovery of the species. Fort Hood is currently implementing the provisions of the ESMP and the current *Biological Opinion*.

3.3 EARTH RESOURCES

3.3.1 Soils

Soil surveys have been completed by the NRCS (formerly the SCS) for Bell (SCS, 1977) and Coryell (SCS, 1985) counties, which encompass all of Fort Hood. Approximately 30 unique soil series occur within the Fort Hood boundaries (Table 3-4). The dominant soils across the installation include the Topsey series, followed by the Real, Eckrant, Doss, and Nuff series.

Shallow, or very shallow soils developed over limestone bedrock (less than 20 inches) make up about 45 percent of land area on Fort Hood. These shallow soils include the Doss, Real, Eckrant, Tarrant, Purves, Pidcoke, and Cho series. Most of these soils are on ridge tops, hilltops and side slopes.

Table 3-4. Soil series names and acreages for soil series that occur within the boundaries of Fort Hood. For each soil series, the acceptable soil loss (tons/ac/year), the soil erosion potential (K factor), and the maximum and minimum rangeland productivity (lbs/ac/year) are given [a]

Component Name	Soil Series Acres	Acceptable Soil Loss (tons/ac/year)	Soil K factor (erosion potential)	Minimum Rangeland Productivity Potential (lbs/ac)	Maximum Rangeland Productivity Potential (lbs/ac/year)
Topsey	31935	5	0.32	3000	6500
Real	25335	2	0.15	1500	3000
Eckrant	20605	1	0.15	1500	3000
Doss	16493	2	0.32	1800	4000
Nuff	15834	5	0.17	2500	5500
Evant	11018	2	0.32	2500	5000
Krum	9583	5	0.32	4000	6500
Rock Outcrop	9479	N/A	N/A	N/A	N/A
Slidell	6564	5	0.32	3000	6000
Bosque	5929	5	0.28	3500	6500
Lewisville	3034	5	0.32	3000	6500
Denton	2729	3	0.32	3000	6500
Cho	2554	2	0.28	1000	2500
Seawillow	1487	5	0.28	2500	5000
Georgetown	1430	2	0.32	2500	4000
Cisco	1390	5	0.37	3000	5000
Purves	1141	1	0.32	1800	3000
Tarrant	996	1	0.1	2000	4000
Bastsil	836	5	0.24	3500	6500
Pidcoke	741	1	0.32	1800	4000
Frio	498	5	0.32	3000	5500
Brackett	392	2	0.17	1500	3000
Crawford	242	2	0.32	3500	6000
Wise	229	3	0.37	3000	6000
Minwells	210	5	0.24	2000	4000
Bolar	176	3	0.2	3000	6500
Speck	76	1	0.32	2000	3800
San Saba	18	2	0.32	3500	6000
Venus	6	5	0.28	3000	6500
Whitewright	1	2	0.32	1800	4000

a Acceptable soil loss, soil erosion potential, and rangeland potential productivity values are those provided in the NRCS Soil Survey Geographic (SSURGO) database for Bell and Coryell counties.

Moderately deep soils developed over limestone bedrock (20 to 40 inches) make up about 20 percent of Fort Hood. These soils include the Denton, Nuff, Speck, Evant, Crawford, and Bolar soil series. Soils in this group are generally well drained. The Speck, Evant, and Crawford soils can be found on broad ridge tops while the Denton, Nuff, and Bolar soils are found on footslopes.

Approximately 35 percent of the land area of Fort Hood contains soils that are deep to very deep (over 40-inch depth). These soils occur on three major landforms: Uplands, Pleistocene terrace deposits, and flood plain sediments. Deep soils include the Slidell, San Saba. Cisco, Wise, Krum, and Houston Black

soil series. The clayey Slidell, San Saba, Krum, and Houston Black series are developed along footslopes of Cretaceous limestones and the Walnut Clay geologic formation. They have slow to very slow permeability and hold large amounts of water. The Cisco and Wise series are loamy soils developed along hillsides in outcrops of the Paluxy Sand geologic formation. They are generally well-drained, but can store water, sometimes making these areas seepy and very easily eroded.

Deep soils developed in Pleistocene stream terraces make up about 8 percent land area on Fort Hood. These soils include the Lewisville, Altoga, Bastsil, and Minwells series. Soils in this group are generally well-drained and have moderate to slow permeability.

Deep soils developed in loamy and clayey alluvium on floodplains of major streams make up about 4 percent of the Fort Hood land area. These soils include the Bosque and Frio soil series. These soils are well-drained and permeability is moderate to slow.

Several soil units on Fort Hood have been classified as Prime Farmland soils. Prime farmland is one of several important types of farmland defined by the USDA. It is determined by soil type (i.e., has parameters conducive for crop growth) rather than land use. Currently, no farming occurs on Fort Hood.

A large portion of the land area on Fort Hood has soils that have relatively high potential for soil erosion (Figure 3-3; Table 3-4). The combinations of soil erodibility, slope, vegetation, disturbance regime, and climate all play important roles in influencing the amount of soil that erodes from a site. The ability of the soil to replenish itself and maintain plant growth is described as the soil loss tolerance (or soil T factor). This is the acceptable amount of soil that can be lost in a year without harming plant productivity, thus allowing production to be sustained economically and indefinitely. Acceptable soil loss values range from 1 to 5 tons per acre per year for soils at Fort Hood (Table 3-4). Values of 1 to 2 tons per acre generally indicate shallow or otherwise fragile soils and 5 tons per acre per year indicate deep soils that are least subject to damage by erosion.

Soil erosion inventories were conducted by the NRCS in 2001 as part of the Land Condition and Trend Analysis Program. This inventory was conducted in conjunction with the rangeland health and trend analysis. Soil erosion (sheet and rill) was found to be highest in the Western Maneuver Area with an average loss of 6 tons/ac/year across 25 sampling points. Soil erosion had a range of 0.1 to 25.1 tons/ac/year (NRCS, 2002). The soil erosion data indicated that soil loss was greater than acceptable rates on 72 percent of the sites inventoried (25 monitoring points). NRCS attributed the high amounts of erosion to a large amount of bare ground and low amounts of vegetation residue on the soil surface. Bare ground averaged 78 percent across the sites and herbaceous perennial production averaged 445 lbs/ac (NRCS, 2002). These conditions reflect the influence of drought conditions, military training and continuous grazing without deferment on the soil and vegetation conditions. Soil erosion in the Eastern Training Area was found to average approximately 2 tons/ac/year across the sites monitored with a range of 0 to 7.8 tons/ac/year. NRCS concluded that 42 percent of the sites monitored exhibited soil erosion rates that exceeded acceptable soil loss rates (NRCS, 2002). West Fort Hood was found to have the lowest erosion rates with an average soil loss of 0.7 tons/ac/year and a range of 0.1 to 3.0 tons/ac/year. No sites were found to have soil losses that exceeded acceptable limits. NRCS attributed this to the high amount of herbaceous perennial production (2,325 lbs/ac) and the lower amount of bare ground (25 percent) resulting from grazing deferments and lack of tracked vehicle use in the area (NRCS, 2002). The higher amount of herbaceous production and increased surface residue protect the soil surface from erosion.

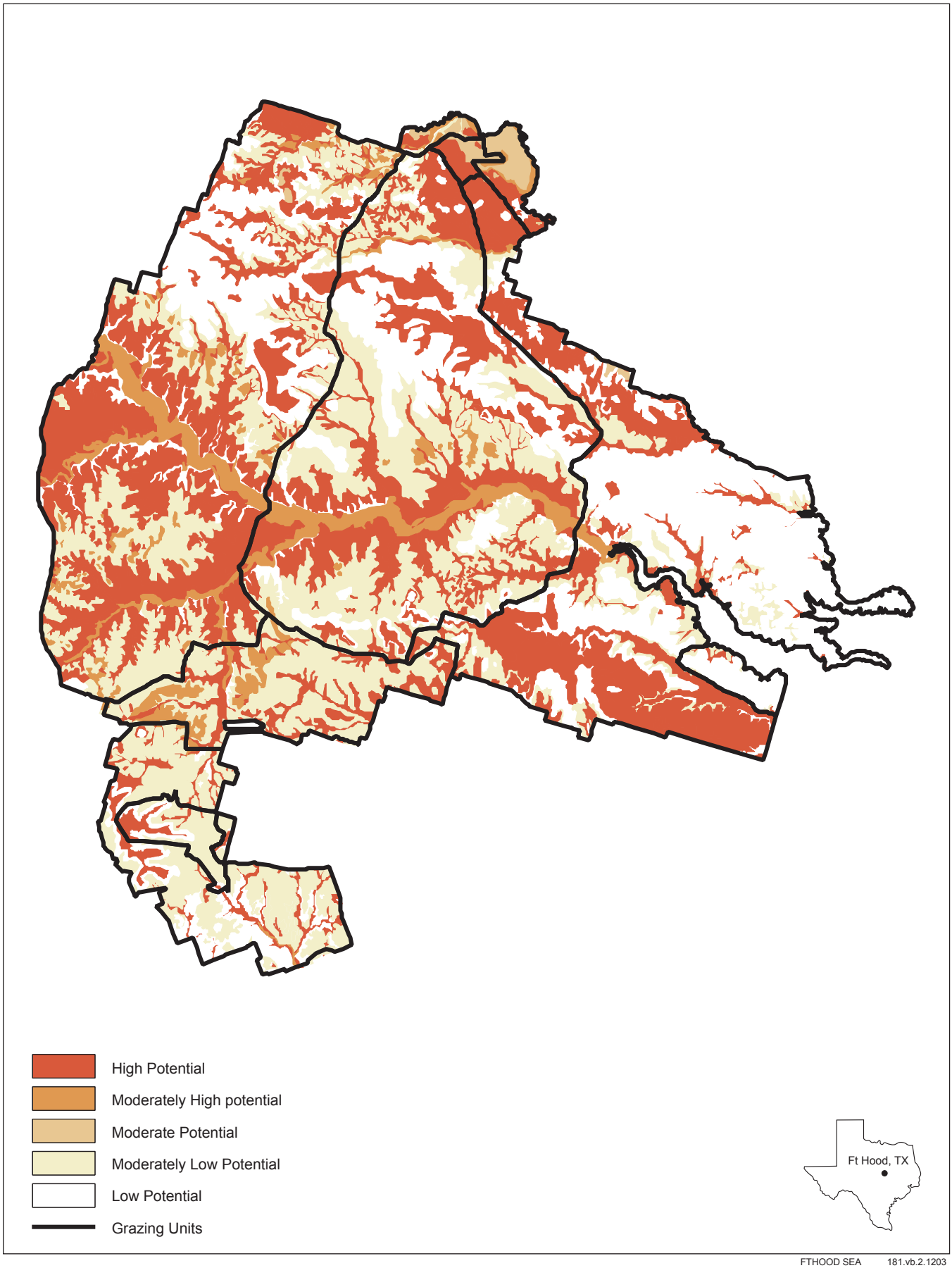

Figure 3-3. Erosion Potential of Soils.

As a result of the 2001 soil erosion survey, NRCS recommended that management actions be taken that would allow scheduled deferments of the Western Maneuver Area from grazing and military activities and that structural improvements be made (i.e., revegetation and sediment catchments). In the Eastern Training Area, the recommendation was made to conduct rest-rotation grazing to allow plant vigor to increase, thus allowing increased soil protection. No new actions were recommended for West Fort Hood (NRCS, 2002).

3.3.2 Geology

The majority of geologic strata on Fort Hood are of the Lower Cretaceous Age. The remaining strata are alluvial deposits and flood plains from the Quaternary Age. The Cretaceous strata are consolidated sedimentary rocks and the erosion of these over the last 70 million years, along with the deposition of unconsolidated materials along the major streams, have produced the landscape that presently exists on Fort Hood (USACE, 1987).

The Cretaceous Age strata on Fort Hood consist of the following formations: Glen Rose formation, Paluxy Sand, Walnut Clay, Comanche Peak Limestone, Edwards Limestone, Kiamichi Clay, Duck Creek Limestone, Fort Worth Limestone, and Denton Clay (Barnes, 1970). Each of these formations, from oldest to youngest, is described below.

The Glen Rose formation consists of limestone and marl, and the exposed rocks are some of the oldest on Fort Hood (90 million years old) (SCS, 1985). Area wise, the Glen Rose Formation is a major outcrop in the southern portion of Fort Hood; and due to its limestone, calcareous clay, sandy marl lithology and differential erosion, the landscape over the outcrop exhibits a typical terraced or 'stair step' configuration. Permeability of the material is low, but load-bearing capability is high. Soils formed from the Glen Rose formation include the Real, Brackett, Topsey, and Doss series.

The Paluxy Sand formation is a fine-grained, friable sandstone. Outcrops range from 12 to 24 inches in thickness, and occur in a very small area on the northeastern edge of the installation. Soils derived from this formation include the Wise and Cisco series.

The Walnut Clay is a limestone, shale, and clay formation with the limestone and clay combining to form a weak marl. This formation crops out at intermediate elevations on the landscape over the Paluxy Sand and Glen Rose Formation. The Walnut Clay formation is the most extensive area-wide on Fort Hood forming rolling plateaus. It is the parent material for the following soil series: Cho, Denton, Slidell, Topsey, and Pidcoke series.

The Comanche Peak formation is limestone on steep slopes under ledges of Edwards Limestone. It outcrops primarily on the slopes of mesa-like hills and topographic high points. Permeability is moderate and load-bearing capability is high. Soils overlaying this formation include the Brackett and Real series.
The Edwards Limestone is a hard, massive, erosion resistant strata that supports overlying less erosion resistant formations, including the Kiamichi Clay, Duck Creek Limestone, Fort Worth Limestone, and Denton Clay formations. Soils mapped over limestone formations include the Bolar, Crawford, Speck, Eckrant, Tarant, Evant and Purves series. Soils mapped over the clay formations are the Denton, Slidell and San Saba series.

Quaternary deposition on Fort Hood is in the proximity of the Leon River and its tributaries, and Cowhouse Creek and its tributaries. Remnants of Pleistocene fluviatile terraces are located above and contiguous to flanks of Holocene flood plain alluvium. The Pleistocene terrace substrate and Holocene alluvium are essentially gravel, sand, silt and clay size sediment eroded from upstream uplands.

Pleistocene terrace soils include the Bastsil, Lewisville, Minwells, and Seawillow series. Holocene flood plain soils include the Bosque and Frio series.

The Balcones Fault Zone passes immediately east of the installation, trending north/southwest. The land to the northwest of this zone (i.e., the land that Fort Hood currently occupies) has, over geologic time, elevated as much as 500 feet. Subsequent erosion of this elevated land is what created the relatively irregular, steeply sloping terrain on the installation (USACE, 1987).

There is no record of major seismic activity in the immediate vicinity of Fort Hood. The nearest major known earthquake was centered about 140 miles northeast of the installation and occurred between 1920 and 1934. This quake had an intensity classed as V to VI using the Modified Mercali Intensity Scale.

Topsoil, sand, gravel, and road base materials are the only known mineral resources that occur within the Fort Hood installation.

3.4 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

The socioeconomic region of influence of the proposed action and alternatives encompasses Fort Hood and its surrounding counties: Bell, Coryell, and Lampasas. These three of Texas's 254 counties comprise the local residence and economic area associated with the installation. Bell and Coryell counties are part of the Killeen-Temple Metropolitan Statistical Area (MSA) while Lampasas County is not a part of a Metropolitan Area.

3.4.1 Demographics and Regional Economics

Population growth in the Killeen-Temple MSA is expected to experience an average annual growth of 1.34 percent over the 30 years from 1990 through 2020. As shown in Table 3-5, this growth is reflected in the cities surrounding the environmental study area, with a projected 30-year increase of 49.1 percent for the entire MSA (City of Killeen, 2000). Lampasas County is projected to grow at a slower rate than Bell or Coryell counties.

Table 3-5. Existing 1990 and Projected 2020 Population

	1990	*2020*	*Percent Change*
Killeen-Temple MSA	255,301	380,638	49.1
Bell County	191,088	279,238	46.1
Killeen	63,535	116,767	83.8
Coryell County	64,213	101,400	57.9
Copperas Cove	27,079	43,053	59.0
Lampasas County	13,521	15,622	15.5

Source: Texas Water Development Board, 1998.

Fort Hood is the major economic driver in the region. Over 50,000 military and civilian personnel are employed by the government facility. Other major employers include the Killeen Independent School District (ISD), Central Texas College District, Copperas Cove ISDs, Metroplex Hospital, and Sallie Mae. Retail trade, service, and State and local government are the sectors providing the greatest sources of employment (City of Killeen, 2000).

The agricultural sector of the regional economy is particularly germane to the proposed grazing lease alternatives being evaluated. Cash receipts from livestock and products in the three counties in 1998 were: Bell–$34,177,000; Coryell–$29,627,000; and Lampasas–$11,358,000. Cash receipts from crops in the three counties in 1998 were: Bell–$13,856,000; Coryell–$4,814,000; and Lampasas–$1,484,000. Total production expenses including hired farm labor expenses in the three counties in 1998 were: Bell–$60,976,000; Coryell–$43,123,000; and Lampasas–$22,211,000.

Data from the Texas Agricultural Statistics Service website (http://www.nass.usda.gov/tx/cecatt1.htm) indicate that the inventory of cattle and calves in Bell and Coryell counties on 1 January 2002 were 47,000 and 68,000, respectively, for a total of 115,000 cattle and calves in the area most directly impacted by this lease.

3.4.2 Economic Justice

EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations requires that Fort Hood make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. For this SEA, 2000 census data are used to estimate the number of persons in minority populations and low-income populations living in areas that could potentially be affected by the project and alternatives. This information, which is included below, describes an aspect of the baseline conditions for the project area.

EO 13045, Protection of Children From Environmental Health Risks and Safety Risks requires that each federal agency identify and assess environmental health risks and safety risks that may disproportionately affect children, and address such risks in their policies, programs, activities and standards. Further, for regulatory sections subject to the EO, agencies must now conduct an evaluation of environmental heath and safety effects on children and include an explanation of why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the agency. Neither the proposed action nor alternatives would have the potential to cause environmental health risks or safety risks that would disproportionately affect children.

The Region of Influence (ROI) for environmental justice is a three-county area consisting of Bell, Coryell, and Lampasas counties. For purposes of this analysis, minority populations and low-income populations were defined as follows:

Minority populations—Persons of Hispanic origin of any race; plus Blacks; American Indians, Eskimos, and Aleuts; and Asian or Pacific Islanders (without double-counting persons of Hispanic origin who are also contained in the latter groups).

Low-income populations—Persons living below the poverty level, which is $12,674 for a family of four, as reported in the 2000 census.

Tables 3-6 through 3-8 detail the minority population composition of the three counties by race.

According to the 2000 U.S. Census, in 2000, there were 85,507 households in Bell County of which 12 percent were living below the poverty level. There were 19,950 families in Coryell County of which 9 percent were living below the poverty level. There were 6,554 families in Lampasas County of which 14 percent were living below the poverty level.

Table 3-6. 2000 Bell County Population Composition by Race

Race	*Total*	*Percent of Total Population*
White	136,359	57.3
Black	48,547	20.4
American Indians, Eskimos, and Aleuts	1,666	0.7
Asian or Pacific Islanders	6,187	2.6
Other race	20,228	8.5
Hispanic origin of any race	24,032	16.7
Total County All Races	*237,974*	

Note: Totals and percentages do not add due to rounding and potential double count of races.
Source: U.S. Census, 2000.

Table 3-7. 2000 Coryell County Population Composition by Race

Race	*Total*	*Percent of Total Population*
White	45,362	60.5
Black	16,345	21.8
American Indians, Eskimos, and Aleuts	675	0.9
Asian or Pacific Islanders	1,350	1.8
Other race	4,724	6.3
Hispanic origin of any race	9,447	12.6
Total County All Races	*74,978*	

Note: Totals and percentages do not add due to rounding and potential double count of races.
Source: U.S. Census, 2000.

Table 3-8. 2000 Lampasas County Population Composition by Race

Race	*Total*	*Percent of Total Population*
White	14,121	79.5
Black	551	3.1
American Indians, Eskimos, and Aleuts	124	0.7
Asian or Pacific Islanders	142	0.8
Other race	1,155	6.5
Hispanic origin of any race	2,664	15.1
Total County All Races	*17,762*	

Note: Totals and percentages do not add due to rounding and potential double count of races.
Source: U.S. Census, 2000.

3.5 CULTURAL RESOURCES

Cultural resources are any prehistoric or historic district, site, building, structure, or object considered important to a culture, subculture, or community for scientific, traditional, religious or other purposes. They include archeological resources (both prehistoric and historic), historic architectural resources, and traditional cultural resources. Only significant cultural resources (as defined in 36 CFR 60.4) are considered for potential adverse impacts from an action. Significant archeological and architectural resources are either eligible for listing, or listed on, the National Register of Historic Places (NRHP). Significant traditional cultural resources are identified by Native American tribes or other groups, and

may also be eligible for the NRHP. For a cultural resource to be eligible or potentially eligible for the NRHP, it must possess integrity and meet one or more of the following criteria:

a. associated with events that have made a significant contribution to the broad patterns of our history; or

b. associated with the lives or persons significant in our past; or

c. embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

d. have yielded, or may be likely to yield, information important in prehistory or history (36 CFR 60:4).

3.5.1 Historical Context

The Fort Hood region has been inhabited since about 12,000 years ago when groups hunted large game and collected the plant resources of the region at the end of the last Ice Age. As the climate gradually warmed, small bands of people used a wider range of plant foods. Burned rock deposits provide archaeological evidence of specialized food processing techniques. Later, hunting activities increased and the bow and arrow came into use. Pottery appeared and regional trade networks were established in the area (U.S. Army, 1995).

Europeans reported encountering Tonkawa Indians in central Texas in the late 1600s (U.S. Army, 1995). Little else is known about the Tonkawa people who may have been displaced by tribes from the plains who had adopted the horse. Wild horse herds are likely to have attracted both Anglo-Americans and Comanches to the area. The Wichita Indians, who had a large village at Waco by the early 1800s, hunted in the hill country around Fort Hood, along with the Comanche people. In the early 1800s, Phillip Nolan operated in the area rounding up horses for resale in Louisiana. Nolan Creek runs through the Main Cantonment Area of Fort Hood.

The Brazos River area (including Bell and Coryell counties) was colonized in the 1830s by Sterling Robertson and was known as "Robertson's Colony" (U.S. Army, 1995). After Texas became part of the U.S. in 1846, the U.S. Army built Fort Gates on the Leon River. The following year, Bell County was organized and the region grew as ranchers grazed cattle and hogs on the open rangeland. In the 1880s, railroad access to the area increased settlement along the railroad route and provided access to regional markets for cash crops such as cotton. Cotton increased in importance through World War I and lasted until the economic decline of the 1920s.

In 1942, Camp Hood was established as a tank destroyer center with 5,630 buildings and 35 firing ranges. Camp Hood was renamed Fort Hood when it became a permanent installation in 1951 (U.S. Army, 1995). Since its establishment, Fort Hood has been used as a training location for U.S. Army armored units.

3.5.2 Archeological Resources

Intensive professional archeological investigations began at Fort Hood in 1949 with the National Park Service (NPS) River Basin Surveys (U.S. Army, 1999a). Since then, more than 2,200 archeological sites (approximately evenly divided between prehistoric and historic sites) have been recorded at the installation. Prehistoric sites (totaling 1,098) range in age from 12,000 years old to less than 150 years old and include flaked rock scatters, campsites, burned rock features, rock quarries, caves and rockshelters, and rock art. According to the Fort Hood archeological database, 167 of these are eligible

for the NRHP, and 325 are potentially eligible. Historic archeological sites (totaling 1,120) include the remains of farms, homes, churches, and cemeteries reflecting Euroamerican occupation of the area. According to the Fort Hood archeological database, 13 are eligible for the NRHP, and 641 are potentially eligible. None of the Fort Hood sites is presently listed on the NRHP (NPS, 2000). Consultation with the Texas Historical Commission regarding cultural resources within the project area has been initiated.

3.5.3 Architectural Resources

Historic architectural resources at Fort Hood include buildings that predate Army ownership of the property and more than 600 (primarily temporary buildings) constructed during the World War II era. An evaluation of historic buildings at the installation in 1990 and 1991 identified structures that were eligible for the NRHP, including several that predate the military installation and one from the World War II era (U.S. Army, 1995). None of the Fort Hood buildings is presently listed on the NRHP (NPS, 2000). Consultation with the Texas Historical Commission regarding cultural resources within the project area has been initiated (see letter in Appendix C).

3.5.4 Traditional Cultural Resources

At Fort Hood, one traditional cultural place has been evaluated as eligible for the NRHP (U.S. Army, 1999a). Fort Hood maintains an informal agreement with the Tonkawa and Comanche tribes regarding the treatment of human remains under the *Native American Graves Protection and Repatriation Act* (NAGPRA) (U.S. Army, 1999a). Consultation with affected Native American groups is ongoing.

3.6 WATER

3.6.1 Groundwater

The primary stratigraphic units that occur in the Fort Hood area are pre-Cretaceous rocks, the Travis Peak formation, the Glen Rose formation, the Paluxy formation, and the Walnut formation. The Walnut formation occurs at the surface of the area, while the Paluxy and Glen Rose formations are exposed only along the channels of the Leon River and its tributaries (USACE, 1999).

The Travis Peak formation, which does not outcrop at the surface in Fort Hood, is the deepest and hydrologically the most important stratigraphic unit in the Fort Hood Region. The Hosston and Hensell members of the Travis Peak formation comprise the aquifer system that is the major source of groundwater supply for Fort Hood. The Pearsall Member, not an aquifer, separates these two strata. The primary sources of groundwater recharge for the Hosston and Hensell members of the Travis Peak formation are rainfall on the outcrop and seepage from streams that cross the outcrop area. This outcrop area covers 1,732 square miles and is located 60 to 80 miles to the northwest of Fort Hood, primarily in Comanche and Erath Counties (USACE, 1999). No major groundwater resources outside of the installation are affected by recharge from within Fort Hood, and recharge that occurs within the installation affects only the small, shallow groundwater supplies that remain on the installation (USACE, 1999).

Potentially sensitive groundwater areas of the Fort Hood Region are the outcrop areas of the Paluxy formation and recent alluvial materials within and adjacent to Cowhouse Creek, Henson Creek, and the Leon River, as well as the Karst or cave systems found throughout the installation. The aquifers recharged by these areas are relatively shallow, therefore they could be affected by hazardous material spills and seepage, but these waters are rarely used and the use is primarily for livestock watering (USACE, 1999).

3.6.2 Surface Water

Fort Hood is situated in the Brazos River Basin. The surface configuration of the land is generally the result of the dissection of numerous small to moderate sized streams, which flow in a southeasterly direction. The Leon River, Owl Creek, and Cowhouse Creek flow into Belton Lake, while Reese Creek flows into the Lampasas River. Nolan Creek, on Fort Hood, flows into the Leon River below Belton Dam. Cowhouse Creek is the major drainage on the military reservation. Belton Lake is owned and operated by the USACE for flood control, conservation, storage, and recreation. The Cowhouse Creek arm of the reservoir is bounded by the installation and is particularly sensitive to sedimentation impacts. The Lampasas River is the major feeder to Stillhouse Hollow Lake. Fort Hood has 200 impoundments and 35 springs. Water resources include 202 surface-ha (500 surface-acres) of lakes and ponds, 88 km (55 miles) of rivers and permanent streams, and 218 km (136 miles) of shoreline of Belton Reservoir (USACE, 1992).

Soil erosion from the installation has resulted in decreased water quality and substantial sedimentation in portions of Belton Lake as well as the smaller water bodies on the installation (USACE, 1999). Soil erosion management actions planned or implemented, as discussed in the INRMP, may reduce the sedimentation issue if the actions are fully implemented (U.S. Army, 2000).

Recent water quality concerns in the Brazos River Basin have focused on fecal coliform contamination, believed to be contributed to by livestock raised in high densities on dairy farms. Portions of the Leon and Lampasas rivers, and Nolan Creek were identified as exceeding the acceptable contaminant loads for fecal coliform (Texas Commission on Environmental Quality [TCEQ]; formerly Texas Natural Resources Conservation Commission [TNRCC], 2002). However, Cowhouse Creek, the primary drainage for the majority of the installation, including those areas most heavily grazed and having the highest erosion rates, had fecal coliform loads within the acceptable standards (TCEQ, 2002). Based on this information, it is assumed that grazing on the installation has contributed little to the fecal coliform issues on the adjacent waterways.

3.7 NOISE

There are three major airports in the area, RGAAF, HAAF, and Killeen Municipal Airport. Existing air space agreements allow Fort Hood aircraft a 152-meter (500-foot) ceiling. The historical use of the study area by approximately 36,000 flight operations monthly has created approximately 30 noise complaints per year (USACE, 1999).

Residential areas and isolated residences, along with farms and ranches, around Fort Hood are the primary sensitive land uses of concern with respect to noise. Most public complaints about Fort Hood activities are caused by aircraft. The cause of the complaints is not always a direct effect of the noise heard by the people, but due to the damage done to facilities or structures when livestock are spooked by sudden noise (USACE, 1999).

3.8 AIR QUALITY

Fort Hood lies totally within the central portion of the EPA Air Quality Control Region (AQCR) #212, also known as the Austin-Waco Intrastate AQCR (USACE, 1999).

The TNRCC, the agency with overall authority for air quality, has adopted the National Ambient Air Quality Standards (NAAQS) for six criteria pollutants–particulate matter (both particulate matter less than

10 microns in Diameter [PM_{10}] and $PM_{2.5}$), nitrogen dioxide, carbon monoxide, sulfur dioxide, and ozone (photochemical oxidants)–and has also adopted the federal standard for lead. Bell and Coryell counties, including all of Fort Hood, are considered to be unclassified or in attainment with regard to each of the NAAQS criteria pollutants (USACE, 1999).

3.9 UTILITIES

3.9.1 Water Supply

Potable water is obtained from the Bell County Water Control Improvement District (BCWCID) #1, which guarantees Fort Hood a delivery of 16.0 million gallons/day (mgd) (60,560 cubic meters/day [cmd]). BCWCID #1 obtains its water from Lake Belton, where it has an annual allotment of 30,800 acre-feet (37.9 million cubic meters) from the Brazos River Authority. An additional 12,000 acre-feet (14.8 million cubic meters) are reserved for the exclusive use of Fort Hood. The installation is served by two 5-million gallon (18,900 cubic meters) in-ground storage tanks adjacent to the Main Cantonment Area, which are supplied through a water distribution system that includes chlorination at the main pumping station. Older cast-iron water pipes in the Main Cantonment Area are being replaced with either concrete or PVC distribution lines in an ongoing improvement process (USACE, 1999).

Average daily consumption in 1993 was approximately 6.26 mgd (719 cmd) for West Fort Hood and 0.19 mgd for North Fort Hood for a total of 6.45 mgd (24,400 cmd). Gross water usage has increased in the surrounding communities due to the expansion of Fort Hood. The communities have sufficient excess capacity to serve this and future anticipated growth (Table 3-9) (USACE, 1999).

Table 3-9. Fort Hood and Local Community Water Use, 1993

Location	*Contract Delivery*	*Pump Capacity*	*Storage Capacity*	*Average Use*	*Peak Flow Demand*	*Average/Person (Gallons/Day)*
Fort Hood	16.0	15.0	10.00	6.45	13.5	146.0
Killeen	23.0	18.0	19.40	8.13	15.8	150.0
Copperas Cove	8.5	11.0	9.20	2.50	3.5	135.0
Harker Heights	3.0	4.0	3.30	2.20	4.0	171.0
Gatesville	3.2	3.8	3.10	1.65	2.1	138.0
Nolanville	0.5	0.5	0.75	0.26	N/A	137.0

Note: Measured in mgd except as noted.
Source: Public Works Department of Fort Hood and local communities, (1994) (USACE, 1999).

3.9.2 Sanitary Sewer

West Fort Hood, which includes both the Main Cantonment Area and West Fort Hood, is served by Treatment Plant #1 of BCWCID #1. The North Fort Hood facility relies on sedimentation ponds that are designed to be expanded to meet the requirements of the additional National Guard troops that are stationed at North Fort Hood every summer. The treatment facilities were constructed in anticipation of heavy use for a few months in the summer, and very low use for the remainder of the year (USACE, 1999).

Killeen is served by both Treatment Plants #1 and #2 of BCWCID #1. Treatment plant #2 has an additional reserve capacity of 3.0 mgd and adjacent land is available to construct another treatment plant with a capacity of 6.0 mgd. However, collection lines to a treatment plant require both force mains and lift stations. Half of Treatment Plant #1's capacity of 15.0 mgd is reserved for Fort Hood. Currently, Fort Hood is using only 4.04 mgd, and discharge is not expected to exceed 5.0 mgd to this plant in the foreseeable future. Growth at Fort Hood is expected to be slight and flatten out, while growth in Killeen is expected to continue, therefore, additional needs are not expected (USACE, 1999).

3.9.3 Solid Waste Disposal

Fort Hood operates a 154-acre Type I landfill under Permit #1866 issued on March 25, 1991, by the Texas Department of Health. The landfill is capable of serving the needs of Fort Hood for approximately 30 more years. Inland Services, under contract to Fort Hood, collects solid waste and operates the landfill (USACE, 1999).

3.9.4 Electric Power

Texas Utilities Electric Company (TXU) provides electricity to Fort Hood through two 138,000-volt transmission lines. One line is from Lampasas and the other is from Killeen; each draws from separate power grids (USACE, 1999).

3.9.5 Natural Gas

The Lone Star Gas Company provides a guaranteed annual delivery of 8,468 million thousand cubic feet (kcf) to Fort Hood (USACE, 1999).

3.9.6 Telephone Service

U.S. Army Information Services Command maintains and operates Fort Hood's primary administrative telephone system. Sprint-CENTEL provides service to residences and contractors at Fort Hood (USACE, 1999).

3.10 TRANSPORTATION

3.10.1 Regional Network

Three major highways connect the Fort Hood region to major cities throughout Texas (see Figure 1-1). Interstate 35, which passes through Temple and Belton east of the installation, connects the region with Waco/Dallas-Fort Worth to the north and Austin/San Antonio to the south. U.S. Highway 190 passes through the southwestern portion of the installation and connects it to the nearby communities of Killeen, Harker Heights, Nolanville, Belton, Temple, Copperas Cove, and Lampasas. U.S. Business 190 parallels the highway and provides direct access to Harker Heights, Killeen, and portions of Fort Hood. U.S. Highway 84 crosses the region immediately north of the installation and provides access with Abilene/Lubbock to the northwest and eastern Louisiana to the east. Interstate 35 may also be accessed southeast of the Killeen/Fort Hood area using State Highway 195. Other major transportation roadways in the Killeen/Fort Hood area are W.S. Young Drive, Rancier Avenue, Hood Road, and Clear Creek Road. Entry to the eastern gate of Fort Hood is provided by Rancier Avenue and Tank Destroyer Boulevard, while access to the western gate is by Clear Creek Road. The main gate accesses U.S. Highway 190 (USACE, 1999).

Several proposed and recently completed improvements to the off-post roadway network, including road widening and connecting projects, have improved traffic movement and safety in the Fort Hood area, but several problem areas persist despite the improvements both on- and off-post (USACE, 1999).

3.10.2 Fort Hood Roadway Network

The roadway network within the Main Cantonment Area at Fort Hood is designed to provide access to installation buildings and facilities. Primary streets, such as Hood Road, Clear Creek Road, Tank Destroyer Boulevard, Battalion Avenue, and Warrior Way, function primarily to collect and distribute traffic. These primary streets are multilane roadways for most of their length within the Main Cantonment Area (USACE, 1999).

Since 1988, several roadway improvements have been completed within the Main Cantonment Area. Most of these projects were upgrades to secondary streets to improve flow to primary streets and specific buildings and facilities (USACE, 1999).

3.11 HAZARDOUS MATERIALS AND ITEMS OF SPECIAL CONCERN

The management and use of compounds regulated under the *Federal Insecticide, Fungicide, and Rodenticide Act* (FIFRA) are performed by the Environmental Management Office (EMO). The installation has an Installation Pest Management Coordinator, who oversees all activities and maintains an application record. All applicators are certified prior to using pesticides at Fort Hood (USACE, 1999).

The largest quantities of bulk transported materials are vehicle fuels (i.e., motor gasoline and diesel fuel) and aviation fuels. Additional transported items include other ignitable and/or flammable materials, corrosives, toxics, and reactive materials such as munitions. These materials are mostly transported in small nonbulk packed quantities (USACE, 1999).

Hazardous materials are widely distributed throughout the installation. Hazardous materials of interest would depend upon the training activities and the specific locations in which they are planned to occur. Information on *Resource Conservation and Recovery Act* (RCRA) and *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) locations within the installation are available through the EPA's CERCLA and RCRA databases and registration reports. Additional EPA-identified sites are listed in the Emergency Response Notifications System Locations database. These and other potentially hazardous materials and/or hazardous material locations can be identified though the TNRCC Waste Management Section (800-832-8244) databases including the leaking tanks report and solid waste registration report (USACE, 1999).

4.0 ENVIRONMENTAL IMPACTS

4.1 LAND USE, AIR SPACE USE, AND VISUAL RESOURCES

Assessment of impacts on land use resulting from the proposed alternatives considered the potential effect of continued cattle grazing on land use, air space use, visual resources, and environmental resource management planning.

Air space and visual resources are not expected to be impacted by any of the alternatives being considered.

Cattle grazing on Fort Hood, specifically in the Live Fire and Impact Areas, has resulted in training delays due to cattle moving within the line of fire, requiring training activities to cease until the cattle are removed. Quantifying the significance of these impacts is difficult given the other causes of delay. However, Range Control has determined that the total delays occurring when the stocking rate is over 750 AUs in the Live Fire and Impact Areas are unacceptable.

Combat Vehicle Crew gunnery proficiency and qualification training–a subset of the primary mission of Fort Hood–is impacted by cattle grazing in the Live Fire/Impact Areas. Table 4-1 depicts the number of times training was forced to be halted on the major gunnery range complexes between October 2001 and October 2002. Though not required under the current lease provisions, but for community relations, health, and safety reasons, gunnery training is halted when cattle are present on the range to allow a range crew to drive the cattle off. As each of these events requires a minimum of 30 minutes to accomplish, almost 250 hours (approximately 11 days) of training time was lost. Total personnel time lost due to the cattle could not be calculated due to varying number of personnel involved in each occurrence.

Table 4-1. Training Shutdowns on Range Complexes on Fort Hood

Range Complex	*2001*			*2002*										
	Oct	*Nov*	*Dec*	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Total*
# 1	0	8	0	0	0	1	0	3	0	0	0	0	1	*13*
# 2	11	2	2	6	1	3	2	6	0	6	0	2	1	*42*
# 3	4	8	4	3	12	3	0	9	6	11	4	4	20	*88*
# 4	16	7	1	1	4	6	4	4	3	7	8	8	13	*82*
# 5	10	10	3	22	35	33	7	15	24	17	19	34	27	*256*
Total	*41*	*35*	*10*	*32*	*52*	*46*	*13*	*37*	*33*	*41*	*31*	*48*	*62*	*481*

Range Complex # 1Blackwell Multi-Use Range (MUR), Pilot Knob MUR, Clear Creek Small Arms
Range Complex # 2Browns Creek MUR, Cow House Machine Gun
Range Complex # 3Hensen Mountain MUR, Dalton Mountain MUR
Range Complex # 4Lone Star MUR, Crittenberger MUR, Owl Creek Assault Course
Range Complex # 5Brookhaven MUR, Trapnell MUR, Sugarloaf MUR, Black Gap Small Arms

In addition to the direct loss of training time, suspending training to clear cattle off the range complex has even greater, second-order effects on training. The tempo of range operations is disrupted, combat vehicle crews must stop and then attempt to restart systems, and resume the intended rhythm of the training scenario. In 2004, construction of another major gunnery range complex (Clabber Creek-Jack Mountain), the Army's first digitally-enabled Multipurpose Range Complex, will be completed. As with all training ranges on the installation, this new range will not be fenced, therefore it will be susceptible to the same delays as has been seen on the ranges presented in Table 4-1. Assuming the stocking rates in Fiscal Year 2002 occur after the new Range Complex is in service, the number of shutdowns due to cattle would be greater.

Though training and grazing can be compatible land uses in most areas at Fort Hood, the intensive and critical training activities that occur in the Live Fire and Impact Areas require additional restrictions on cattle densities in these areas. Training access to these ranges must be unobstructed or delayed in order to fulfill the semi-annual requirement to meet Army-mandated qualification standards, coupled with the elevated involvement of Fort Hood units in the prosecution of the Global War On Terrorism (GWOT) that will require more frequent gunnery exercises. Therefore, the total number of cattle in the Live Fire and Impact Areas, in total, shall not exceed 750 AUs (which represents the maximum number that can reasonably be controlled without significant impacts on training).

4.1.1 Alternative 1, No Grazing

Discontinuing cattle grazing on Fort Hood as represented by the No Action Alternative would result in fewer disruptions to the military mission of Fort Hood, as training activities would not be delayed due to cattle in the training and Live Fire Areas.

Recreational uses of the installation, including hunting and fishing, likely would benefit with implementation of this alternative due to the expected improvement in range condition and water quality (discussed in Sections 4.2.1.1 and 4.2.4), and the resulting enhancement in the populations of game and fish species (discussed in Section 4.2.1.2).

Potential impacts to Environmental Resource Planning are expected to be beneficial and include increased success in vegetation restoration projects because of the lack of cattle to remove new growth, which in turn reduces soil erosion to some degree, and leads to the beneficial impact of accumulation of fuels to allow prescribed burning to maintain the vegetation communities. However, as fuels accumulate over an extended period, the size and intensity of the prescribed burning program must be increased, or grazing must be allowed, to remove the excess fuel to prevent uncontrolled range fires.

Land Use, Air Space Use, and Visual Resources: Conclusion. No adverse impacts are expected.

4.1.2 Alternative 2, 25 percent Harvest Efficiency

Cattle grazing as proposed in Alternative 2 would result in continued training delays in the Live Fire and Impact Area because the stocking rate in this area would exceed 750 AUs, the level above which training delays are unacceptable.

Impacts on recreational uses of the installation would likely occur because of the anticipated continued decline in the ecological condition of the range and water quality (discussed in Sections 4.2.1.1 and 4.2.4, respectively), and the resulting negative impacts on the game and fish species (discussed in Section 4.2.1.2).

Cattle grazing under this alternative would impact Environmental Resource Planning primarily through the continued conflict of cattle grazing on the new vegetation growth on environmental restoration projects. Environmental restoration can include brush removal, ripping to relieve soil compaction, or construction of erosion control structures. Whether the restoration includes seeding or not, the new vegetation must be given time to become established before grazing is allowed. With uncontrolled grazing (i.e., no fencing) and using the relatively high stocking rates under this alternative, restoration programs would not be able to meet their objectives.

In addition to the conflicts with the Environmental Restoration programs, this alternative would result in an increased work load for the NRMB of Fort Hood. These individuals will now be playing a more substantial role in implementing the yearly forage inventory, calculating stocking rates as described under

this alternative, and potentially enforcing the stocking rate adjustments. To do so, additional financial and staff resources may be required. If these resources are not made available, planning, management, and oversight for other resources may be adversely impacted.

Land Use, Air Space Use, and Visual Resources: Conclusion: The delays caused by exceeding the 750 AUs limit in the Live Fire and Impact Areas are substantial. Impacts on resource planning, particularly restoration planning, will be substantial. Other impacts would not be substantial.

4.1.3 Alternative 3, Maintenance Threshold

Cattle grazing as proposed in Alternative 3 would result in continued training delays and associated costs for the military. Due to the intensity of training on the installation, these delays are considered substantial and unacceptable to installation managers.

Implementation of this alternative will result in continued but reduced impacts on recreational activities because of the maintained status of the ecological health of the range, soil erosion, and water quality, and the resulting impacts on game and fish populations. However, implementation of actions in the INRMP to address these issues may minimize the impacts of the continued grazing under this alternative.

Cattle grazing under this alternative, as under Alternative 2, would impact Environmental Resource Planning primarily through the continued conflict of cattle grazing on the new vegetation growth on environmental restoration projects. Environmental restoration can include brush removal, ripping to relieve soil compaction, or construction of erosion control structures. Whether the restoration includes seeding or not, the new vegetation must be given time to become established before grazing is allowed. With uncontrolled grazing (i.e., no fencing), and even with the reduced stocking rates under this alternative, restoration programs would be less likely to meet their objectives.

In addition to the conflicts with the Environmental Restoration programs, this alternative would result in an increased work load for the NRMB of Fort Hood. These individuals will now be playing a more substantial role in implementing the yearly forage inventory, calculating stocking rates as described under this alternative, and potentially enforcing the stocking rate adjustments. To do so, additional financial and staff resources may be required. If these resources are not made available, planning, management, and oversight for other resources may be adversely impacted.

Land Use, Air Space Use, and Visual Resources: Conclusion: The delays caused by exceeding the 750 AUs limit in the Live Fire and Impact Areas are substantial. Impacts on resource planning, particularly restoration planning, will be substantial. Other impacts would not be substantial.

4.1.4 Alternative 4, Conservation Threshold

Cattle grazing as proposed in Alternative 4 would result in continued training delays and associated costs for the military because the stocking exceeds 750 AUs in the Live Fire and Impact Area. Due to the intensity of training on the installation, these delays are considered substantial and unacceptable to installation managers.

Implementation of this alternative will result in continued but reduced impacts on recreational activities because of the maintained status of the ecological health of the range, soil erosion, and water quality, and the resulting impacts on game and fish populations.

Cattle grazing under this alternative, as under Alternatives 2 and 3, would impact Environmental Resource Planning primarily through the continued conflict of cattle grazing on the new vegetation

growth on environmental restoration projects. Environmental restoration can include brush removal, ripping to relieve soil compaction, or construction of erosion control structures. Whether the restoration includes seeding or not, the new vegetation must be given time to become established before grazing is allowed. With uncontrolled grazing (i.e., no fencing), and even with the reduced stocking rates under this alternative, restoration programs would be less likely to meet their objectives.

In addition to the conflicts with the Environmental Restoration programs, this alternative would result in an increased work load for the NRMB of Fort Hood. These individuals will now be playing a more substantial role in implementing the yearly forage inventory, calculating stocking rates as described under this alternative, and potentially enforcing the stocking rate adjustments. To do so, additional financial and staff resources may be required. If these resources are not made available, planning, management, and oversight for other resources may be adversely impacted.

Land Use, Air Space Use, and Visual Resources: Conclusion: The delays caused by exceeding the 750 AUs limit in the Live Fire and Impact Areas are substantial. Impacts on resource planning, particularly restoration planning, will be substantial. Other impacts would not be substantial.

4.1.5 Alternative 5, Combined Approach

Cattle grazing as proposed in Alternative 5 would not cause substantial training delays because the stocking rate is within the 750 AUs in the Live Fire and Impact Area.

Recreational uses of the installation, including hunting and fishing, likely would benefit with implementation of this alternative due to the expected improvement in range condition and water quality (discussed in Sections 4.2.1.1 and 4.2.4), and the resulting enhancement in the populations of game and fish species (discussed in Section 4.2.1.2).

Cattle grazing under this alternative will have minimal adverse impacts on Environmental Resources Planning because it authorizes NRMB personnel to adjust and closely monitor stocking rates in areas in accordance with goals or objectives for other resources, such as deferring grazing on areas burned or chained for brush removal, or where restoration projects are implemented. The INRMP currently being implemented on the installation included a grazing program similar to this alternative, so potential grazing impacts were included as a factor in management plans and objectives for other resources.

However, because the NRMB of Fort Hood will now be playing a more substantial role in implementing the yearly forage inventory, calculating stocking rates as described under this alternative, and potentially enforcing the stocking rate adjustments, additional financial and staff resources may be required. If these resources are not made available, implementation, management and oversight for other resources may be adversely impacted.

Land Use, Air Space Use, and Visual Resources: Conclusion: The delays caused by grazing within the 750 AUs limit in the Live Fire and Impact Areas are not substantial. Impacts on resource planning, particularly restoration planning, will be substantial. Other impacts would not be substantial.

4.2 BIOLOGICAL RESOURCES

4.2.1 Alternative 1, No Grazing Alternative

4.2.1.1 Flora

Military training activities (especially tracked vehicles) and grazing by livestock, alone or in combination, can disturb vegetation. The impacts to vegetation are similar for both in that they remove or destroy vegetation (Milchunas et al., 1999) and can lead to changes in what plant species are found in an area (Fuhlendorf and Smeins, 1997; Milchunas et al., 1999). Impacts to vegetation by tracked vehicles is more indiscriminate in that almost all vegetation is destroyed during this type of activity, whereas livestock selectively graze individual species of plants (Milchunas et al., 1999). Thus the types of vegetation change can be quite different for these disturbances. Both intensity and duration of the disturbance drive the severity of the impact. For example, in the Edwards Plateau of Texas, heavy grazing by livestock for a duration of 45 years caused increased abundance of shortgrasses, whereas taller, more productive midgrasses were more abundant under moderate to no grazing (Fuhlendorf and Smeins, 1997). In Arizona, plant cover did not differ significantly between grazed and ungrazed sites, but cover of midgrasses was significantly different (Brady et al., 1989). In Colorado, 10 years of military activity (mostly tracked vehicles) at the Pinyon Canyon Maneuver Site led to a decrease in long-lived perennial species, and an increase in short-lived perennials (Milchunas et al., 1999).

Intensive training with tracked and wheeled vehicles commonly disturbs vegetation by crushing/and or removing vegetation on the soil surface (Thurow, 1990; Milchunas et al., 1999). This disturbance, combined with intensive or localized over-grazing does not allow the vegetation to become re-established and eventually removes the preferred perennial herbaceous species, promoting the invasion and establishment of undesirable annual grasses and forbs, as well as woody shrubs and trees such as juniper (NRCS, 1998).

Results of the rangeland health and condition survey conducted in 2001 (NRCS, 2002) indicated that productivity of grazeable perennial species declined 55 percent on average in the West Fort Hood management units, 46 percent in the Eastern Training Area, and 76 percent in the Western Maneuver Area. NRCS concluded that these declines were the result of multi-year drought conditions, continuous grazing, and concentrated military training (NRCS, 2002). Rangeland health was found to be declining at the majority of sites sampled in the Eastern Training Area and the Western Maneuver Area. In both areas, approximately 80 percent of the sites had declining rangeland health conditions. Under this alternative of no grazing, perennial grasses and other desirable species likely will become reestablished throughout areas where the habitat is conducive for growth of those species. Such a response to this change in land use may require several years of normal to above-normal precipitation. This should lead to a reverse in the trend of declining rangeland health. However, increased military activities would delay full recovery of the vegetation. Deferral of areas from military training through the ITAM out-area program would defer maneuvers in heavily impacted areas, thus accelerating the response of desirable perennial species under this alternative. In areas where woody shrubs and trees have become established to the exclusion of others, grazing and deferment alone generally will not lead to an increase in desirable perennial species. In this case, mechanical removal of woody shrubs and trees (e.g., juniper) or prescribed burns may be necessary to remove these invading shrubs and allow the desirable herbaceous species to become established. Reseeding of areas with desirable species may also be required to accelerate a reversal of declining range condition.

Under this alternative, deferring grazing should allow the vegetation to recover and plant biomass to increase, however, this can increase the risk of range wild fires. This risk would be compensated by the existing procedures for assessing the potential risk of fires and identifying the best management methods

for reducing the risk. An active prescribed burning program would be a necessity with the absence of livestock grazing. The current INRMP (U.S. Army, 2000) describes the *Fire Management Plan* that has been implemented to reduce the risk of wildfires. Prescribed burning will be an integral part of this plan. An active prescribed burning program will be essential for reducing the risk of wildfires during a deferment of livestock grazing.

4.2.1.2 Fauna

The potential changes in the flora from discontinuing livestock grazing would likely result in a change in the faunal community, because species will respond differently to the altered habitat (Brown, 1978; Bock et al., 1984). An initial direct beneficial impact of removing the cattle would be a reduction in the abundance of cowbirds on the interior portions of the installation because cowbirds are attracted to cattle that disturb vegetation and stir up insects that the cowbirds feed on. Studies on the installation have shown that cowbirds feed primarily, but not exclusively, in the presence of cattle (Koloszar and Horne, 1999), therefore cowbirds likely would continue to be present on the installation. Additionally, because cowbird trapping would be continued, cowbird abundance on the installation would decline and the resulting parasitism of songbird nests would be reduced, but not eliminated.

Other direct impacts of the removal of cattle would be a reduction in the trampling of the nests of birds that nest on the ground. This impact likely is beneficial though minimal on Fort Hood at this time, because trampling has been shown to be a minor contributor to reduced nesting success of these species unless stocking rates are extremely high (Bareiss et al., 1986), and because the abundance of ground-nesting birds is relatively low in areas in poor to fair range condition which does not provide sufficient cover to protect the nests from predation (Buttery and Shields, 1975). Few studies have addressed direct impacts of grazing on other non-game animals. The direct impacts of cattle grazing on white-tailed deer behavior is highly dependent on ecological condition, and in areas in seriously poor ecological condition, cattle are forced to increase the amount of browse species in their diet thus increasing potential competition with deer (Loft et al., 1991; Teer, 1984).

Indirect impacts on fauna of removing the cattle from the installation are initially beneficial and are associated with the expected improvement in ecological condition of the range. Numerous studies have shown that the abundance and species diversity of birds (Buttery and Shield, 1975; Brown, 1978; Bock et al., 1984; Taylor, 1986; Sedgwick and Knopf, 1987; Bock and Bock, 1998; Popotnik and Giuliano, 2000) and rodents (Bock et al., 1984), and abundance of white-tailed deer (Cook, 1984; Teer, 1984; Loft et al., 1991; Ragotzkie and Bailey, 1991) are greater on range lands in good or excellent ecological condition, often the result of light or closely managed moderate grazing intensity. Similarly, fishes and other aquatic species found in and adjacent to surface waters are more abundant in areas in good to excellent ecological condition because of reduced soil erosion and sedimentation in the waters and increased diversity of plant species.

The improved ecological condition results in increased herbaceous vegetation that is available for food and shelter resources provided by the increased herbaceous vegetation. However, extended periods of deferred grazing, and the resulting build-up of rank vegetation will begin to reduce the beneficial effects due to loss of preferred habitat for some species or result in uncontrollable wildfires that destroy the shrub communities used by numerous birds and other wildlife. Implementation of actions in the INRMP, specifically the prescribed burning program, and an annual review of the potential value and need for a grazing outlease program, will reduce the risk of such a development.

4.2.1.3 Threatened or Endangered Species

Discontinuing grazing for this period of time would likely benefit the golden-cheeked warbler and the black-capped vireo. The most substantial direct benefit for these species would be the expected reduction in the abundance of brown-headed cowbirds on the interior portions of the installation, and the resulting reduction in brood parasitism by this species. A perceived negative impact to the species would be the termination of the MOU with the CTCA that requires the CTCA to manage and support cowbird trapping on private lands adjacent to the Eastern Training Areas (USFWS, 1999). However, the cowbird trapping and shooting programs would be continued by the installation. Assuming future results reflect past results, the parasitism rates likely would remain within the threshold of 10 percent established through formal consultation with the USFWS as an indicator of significant impact of cowbird parasitism on these species (USFWS, 2000). Termination of the MOU in this case could have a substantial impact on the working relationship between the CTCA and Fort Hood, however, the endangered species would not be impacted.

Indirect impacts of discontinuing grazing for this period would be associated with the expected improvement in the ecological condition of the range, and the resulting increase in abundance and diversity of bird species in the area (discussed in Section 4.2.1.2). The increased abundance and number of bird species will increase the number of potential "targets" for cowbird parasitism, as well as other predators, reducing the pressure on the protected birds (Barber and Martin, 1997).

Discontinued grazing may have an indirect detrimental impact on habitat for these species if vegetation, particularly in the grasslands, is allowed to become dense enough to carry a range fire into the shrub and forest communities. The 1996 range fire burned over 2,000 ha of golden-cheeked warbler and black-capped vireo habitat (U.S. Army, 2000; INRMP). Though much of this area will revegetate naturally and produce habitat for the black-capped vireo, the older stands of juniper that are required for golden-cheeked warblers will require up to 30 years to recover. If grazing is discontinued and several years of normal or above normal precipitation occurs over the next few years, the condition of the range will recover and biomass production will increase, increasing the risk of range fires. Removing cattle from a portion of the Eastern Training Area for 2 years resulted in significant increases in biomass production (The Nature Conservancy of Texas, 1999). However, the installation has implemented new methods for identifying periods of high risk of range fires and new restrictions on the use of equipment that could ignite range fires during these periods (USFWS, 2000). These measures, combined with a prescribed burning plan should minimize the likelihood of these fires.

Bald eagles, whooping cranes, and peregrine falcons will not be affected by this alternative because of the frequency of occurrence of the species on the installation. The Texabama croton would not likely be impacted by this alternative because the species is not likely to be grazed, and it apparently is not affected by fire since the known individuals survived the 1996 range fires (USFWS, 2000). Limited information is available to speculate whether discontinued grazing would impact cave-dwelling species on the installation, however, reduced soil erosion resulting from the improved ecological condition would likely benefit these species due to reduced run-off and enhanced water infiltration. Impacts to the Texas horned lizard are difficult to determine due to the limited information on its distribution on the installation.

Biological Resources: Conclusion: Potential impacts of the No Grazing Alternative on the biological resources in the area are likely to be beneficial. Improved ecological condition of the range would improve the condition of all of the biological resources.

4.2.2 Alternative 2, 25 percent Harvest Efficiency

4.2.2.1 Flora

Under this alternative, the use of the 25 percent Harvest Efficiency approach (see Section 2.1.2.2 for description) would result in declining range condition and health in the majority of the ecological sites within the Eastern Training Area, Western Maneuver Area, and the southern portion of West Fort Hood because of the current poor condition of these sites. Although the 25 percent Harvest Efficiency calculation is deemed a conservative calculation of stocking rate (Hanselka et al., 2002), it does not allow sufficient vegetation to be left after grazing as residue for protection from soil erosion on sites that are currently in poor condition. For example, many of the ecological sites in the Western Maneuver Area and the Eastern Training Area have grazeable perennial vegetation below 750 lbs/ac. The Texas Cooperative Extension Service recommends a minimum of 750 to 1,000 lbs/ac acre of residue on midgrass ecological sites. Since many of the sites within the Western Maneuver Area and Eastern Training Area are already at or below this residue threshold, the use of a 25 percent Harvest Efficiency for setting stocking rates on these sites will result in a loss of half of the forage, resulting in less residue, continued loss of desired perennial species, and continued decline in rangeland health. A confounding concern with the use of the 25 percent Harvest Efficiency for calculating stocking rates on the installation is that the potential removal or loss of vegetation due to training activities is not considered. Half of the forage on a site is removed or lost to cattle production, then an unknown proportion of the remaining vegetation is lost or destroyed by training, leaving even less vegetation available as residue.

Since at least 1996 and until March 2002, the stocking rate for the installation was 3,500 AUs as designated in the 1996 lease (US Army, 1996). This stocking rate was calculated using the 25 percent Harvest Efficiency method. During that period, Fort Hood had not substantially adjusted stocking rates until March 2002 when a supplemental lease was implemented and stocking rate was decreased to 2,000 AUs. In 1997, NRCS conducted a vegetation inventory and rangeland condition analysis for the installation. At that time they noted that over 80 percent of the sites sampled on the installation had low rangeland similarity indices (25 percent or less), which means that very few of the sites were comparable to the historical climax plant community defined for those sites (NRCS, 1998). During these efforts the NRCS also noted that rill and gully erosion was excessive in large portions of the Western Training Area, and that open prairies on the western side of Fort Hood were in very poor ecological condition. NRCS attributed these problems to excessive military training and excessive livestock grazing on open, flat topography (NRCS, 1998).

After 4 years of grazing at 3,500 AUs, rangeland condition and health apparently did not improve. Results of the rangeland health and condition survey conducted in 2001 (NRCS, 2002) indicated that productivity of grazeable perennial species declined 55 percent, on average, in the West Fort Hood management units, 46 percent in the Eastern Training Area, and 76 percent in the Western Maneuver Area. NRCS concluded that these declines were the result of multiyear drought conditions, continuous grazing, and concentrated military training (NRCS, 2002). Rangeland health was found to be declining at the majority of sites sampled in the Eastern Training Area and the Western Maneuver Area. In both areas, approximately 80 percent of the sites had declining rangeland health conditions.

Under this alternative, the stocking rate for the installation would be 4,021 AUs. Based on historical trends at the site and with the current levels of military training in the Western Maneuver Area and Eastern Training Area, there is no evidence that any improvement in rangeland health and condition would occur in these areas. Therefore, it is expected that this alternative would lead to significant impacts to flora in the Western Maneuver Area and the Eastern Training Area, and possibly other areas after several years into the lease. Also, the effectiveness of a prescribed burning program for reduction of

invasive woody species in these areas would be reduced due to a lack of fine-fuels due to grazing and military activities.

In the Live Fire Area, North Fort Hood, and the northern portion of West Fort Hood, this alternative should not lead to excessive impacts to flora since the majority of the sites in this area have perennial forage production that would result in an adequate amount of residue and not lead to over-grazing under continuous grazing without deferment. However, issues related to seasonality and palatability of the forage species will have to be addressed and factored into the *Grazing Management Plan* for some of these areas.

4.2.2.2 Fauna

Grazing at the stocking rates under this alternative likely would result in negative impacts to the wildlife on the installation. Grazing throughout the installation would continue to attract cowbirds, however, the trapping program currently being implemented has proven effective at reducing the impacts on endangered birds, therefore other songbird species likely receive the same benefit. Other direct impacts of grazing on faunal species, such as trampling of ground-nesting birds or behavioral exclusion of deer likely would occur at the stocking rates in this alternative, similar to the levels at which the impacts are currently occurring.

Indirect impacts on faunal species will be correlated with recovery of the ecological health of the range. The stocking rates under this alternative are lower than under previous leases, however, they are substantially higher than would be needed to see substantial recovery of the range.

Implementation of actions in the INRMP and the prescribed burning plan, as well as development of a *Grazing Management Plan* likely will enhance any beneficial impacts of this alternative.

4.2.2.3 Threatened or Endangered Species

Grazing throughout the installation at the stocking rates under this alternative likely would result in impacts to the golden-cheeked warbler and black-capped vireo in the form of brown-headed cowbird parasitism. However, implementation of the cowbird trapping and shooting programs has been shown to reduce those impacts to levels considered acceptable by the USFWS, which is 10 percent parasitism rate (USFWS, 2000). Under this alternative, the trapping and shooting programs would continue, run by the lessee or the NRMB, in order to keep parasitism rates within this threshold.

Under this alternative, indirect impacts on the warbler and vireo may result from the continued fair to poor ecological condition of the range, however, these impacts are not considered excessive since the species are found primarily in the canopies of juniper and hardwood trees.

Bald eagles, whooping cranes, and peregrine falcons will not be affected by this alternative because of the frequency of occurrence of the species on the installation. The Texabama croton would not likely be impacted by this alternative because the species is not likely to be grazed, and it apparently is not affected by fire since the known individuals survived the 1996 range fires (USFWS, 2000). Limited information is available to speculate whether grazing would impact the cave-dwelling species on the installation, however, if soil erosion continues at current levels due to the lack of improvements in ecological condition, current impacts from run-off and limited water infiltration could continue. Impacts to the Texas horned lizard are difficult to determine due to the limited information on its distribution on the installation.

Biological Resources: Conclusion: The flora and fauna likely will be impacted under this alternative, primarily due to the lack of a recovery in the ecological condition of the range. Impacts to the golden-cheeked warbler and black-capped vireo likely would be mitigated with the cowbird trapping and shooting programs. Impacts on biological resources are likely to be excessive in the Western Maneuver Area and Eastern Training Area because of the further decline in ecological condition and loss of preferred perennial vegetation species.

4.2.3 Alternative 3, Maintenance Threshold

4.2.3.1 Flora

Under this alternative, a minimum residue of 750 lbs/ac would be maintained on areas that are already producing this much perennial herbaceous vegetation. On areas producing less than 750 lbs/ac of perennial herbaceous vegetation, no stocking rate would be assigned and grazing would be deferred for the year. The implementation of this alternative would most likely lead to maintenance of current conditions. Since these areas are at the low end of the residue threshold recommended by the Texas Cooperative Extension Service (Hanselka, 2001), recovery of vegetation would be slower than at sites having higher residue. In areas having perennial herbaceous vegetation already below the maintenance threshold (e.g., the majority of ecological sites within the Western Maneuver Area and the Eastern Training Area) this alternative would likely lead to a slight improvement in rangeland health. However, given the already poor condition of these sites, years of above average rainfall would most likely be required for substantial range improvement. Also, increased military activities that would lead to a reduction in vegetation below the maintenance threshold would reduce any positive effects that this stocking rate would have on perennial vegetation and ecological condition. For substantial improvement in the range condition, training activities would have to be reduced and extensive revegetation and restoration would be required.

Maintenance of a 750 lb/ac residue threshold should not lead to increased probability of wildfires. The minimum amount of continuous fine fuel required to carry a fire in this region is about 1,000 lbs/ac. However, the vegetation residue provided by this alternative would not lead to an effective prescribed burning program. Deferment of areas from grazing and military activities would be required to make prescribed burning efficient for reduction of invasive woody species.

4.2.3.2 Fauna

Grazing cattle at this light-to-moderate stocking intensity, considering the current poor to fair ecological condition of many areas of the range, is likely to have minimal detrimental or beneficial impacts on the fauna on the installation. Cattle grazing of any intensity will attract cowbirds onto the installation, thus resulting in detrimental impacts on bird species through nest parasitism. Ongoing cowbird trapping programs would be continued to address these issues, so impacts would be similar to current status. As discussed for the No Grazing Alternative, direct impacts of cattle on bird and other animal species is minimal unless stocking intensity is so high that animals or nests are trampled.

Similar to the no grazing alternative, range in good to excellent ecological condition is likely to have an increased abundance and diversity of faunal species. With a reduction in the stocking intensity, the ecological condition of the range is expected to improve, potentially benefiting an array of fauna, including aquatic species. The implementation of the INRMP actions, particularly the prescribed burning plan and the grazing management plan will allow managers to adjust actions to meet the needs of the species.

4.2.3.3 Threatened or Endangered Species

Grazing throughout the installation at the stocking rates under this alternative likely would result in impacts to the golden-cheeked warbler and black-capped vireo in the form of brown-headed cowbird parasitism. However, implementation of the cowbird trapping and shooting programs has been shown to reduce those impacts to levels considered acceptable by the USFWS, which is 10 percent parasitism rate (USFWS, 2000). Under this alternative, the trapping and shooting programs would continue, run by the lessee or the NRMB, in order to keep parasitism rates within this threshold.

Under this alternative, indirect impacts on the warbler and vireo would be less likely than under Alternative 2 because the reduced stocking rates are expected to result in improved ecological health across the installation.

Impacts to other protected species would be similar to those described in the previous alternative.

Biological Resources: Conclusion: Continued adverse impacts to the flora and fauna are likely from this, primarily from the maintenance or relatively slow recovery of the ecological condition under these stocking rates. Impacts under this alternative would not be as substantial as under Alternative 2 where stocking rates are higher. Impacts to the golden-cheeked warbler and black-capped vireo likely would be mitigated with the cowbird trapping and shooting programs.

4.2.4 Alternative 4, Conservation Threshold

4.2.4.1 Flora

Under this alternative, a minimum residue of 1,000 lbs/ac would be maintained on areas that are already producing this much perennial herbaceous vegetation. On areas not producing 1,000 lbs/ac of perennial herbaceous vegetation, no stocking rate would be assigned. The implementation of this alternative would most likely lead to a slight to moderate improvement in current conditions. In areas having perennial herbaceous vegetation already below the conservation threshold (e.g., the majority of ecological sites within the Western Maneuver Area and the Eastern Training Area) this alternative would likely lead to slight increases in desired species and increased vigor in already established plants. However, given the already poor condition of these sites, above average rainfall would most likely be required for an upward trend in ecological condition. Also, increased military activities that would lead to a reduction in vegetation below the conservation threshold would reduce any positive effects that this stocking rate would have on perennial vegetation and ecological condition.

Maintenance of a 1,000 lbs/ac residue threshold could lead to increased probability of wildfires. The minimum amount of continuous fine fuel required to carry a fire in this region is about 1,000 lbs/ac. Impacts to vegetation caused by wildfires are most likely to be positive in that invasive shrubs would likely be reduced. The vegetation residue provided by this alternative would provide fine fuel needed for a prescribed burning program, but a 1,000 lbs/ac fine fuel load is considered sub-optimal for killing of invasive juniper seedlings (Wright and Bailey, 1982). Deferment of areas from grazing and military activities would be required to allow fine fuel build-up to make prescribed burning efficient for reduction of invasive woody species.

4.2.4.2 Fauna

Grazing at the light stocking rates under this alternative, considering the current poor to fair ecological condition of many areas of the range, is likely to have substantial beneficial impacts on the fauna on the installation, assuming the ecological health of the area improves. Cattle grazing of any intensity will

attract cowbirds onto the installation, thus resulting in detrimental impacts on bird species through nest parasitism. Ongoing cowbird trapping programs would be continued to address these issues, so impacts would be similar to current status. As discussed for the no grazing alternative, direct impacts of cattle on bird and other animal species is minimal unless stocking intensity is so high that animals or nests are trampled.

Similar to the no grazing alternative, range in good to excellent ecological condition is likely to have an increased abundance and diversity of faunal species. With a reduction in the stocking intensity, the ecological condition of the range is expected to improve, potentially benefiting an array of fauna, including aquatic species. The implementation of the INRMP actions, particularly the prescribed burning plan and the grazing management plan will allow managers to adjust actions to meet the needs of the species.

4.2.4.3 Threatened or Endangered Species

Grazing throughout the installation at the stocking rates under this alternative likely would result in impacts to the golden-cheeked warbler and black-capped vireo in the form of brown-headed cowbird parasitism. However, implementation of the cowbird trapping and shooting programs has been shown to reduce those impacts to levels considered acceptable by the USFWS, which is 10 percent parasitism rate (USFWS, 2000). Under this alternative, the trapping and shooting programs would continue, run by the lessee or the NRMB, in order to keep parasitism rates within this threshold.

Under this alternative, indirect impacts on the warbler and vireo would be less likely than under previous alternatives because the reduced stocking rates are expected to result in improved ecological health across the installation.

Impacts to other protected species would be similar to those described in the previous alternative.

Biological Resources: Conclusion: Impacts to the flora and fauna in many portions of the installation likely would be beneficial due to the reduced stocking rates, assuming ecological condition of the range improves. However, in some areas where the range condition is poor and erosion is severe, grazing even at the low stocking rates of this alternative would continue to have substantial impact on the flora of the area. Impacts to the golden-cheeked warbler and black-capped vireo likely would be mitigated with the cowbird trapping and shooting programs.

4.2.5 Alternative 5, Combined Approach

4.2.5.1 Flora

Under this alternative, grazing will be deferred in the management units within the Western Maneuver Area, Eastern Training Area, and the southern portion of West Fort Hood. Under this alternative deferment of grazing will allow the vegetation to make progress toward improved range condition if adequate precipitation occurs. Recovery of these areas could be rapid following deferment. A brief but significant reduction in stocking rate in the Eastern Training Area during 1996 to 1998 resulted in a significant increase in biomass production of herbaceous grassland species (The Nature Conservancy of Texas, 1999). In areas of continuing military activities, the deferment of grazing would allow the herbaceous perennial vegetation to become reestablished despite the maneuver activities because localized over-grazing on these disturbances would be reduced, damaged plants would be able to resprout and grow to a size that would withstand grazing. Continued deferment of these areas over a number of years would minimize the potential recurrence of the substantially reduced ecological health observed in these areas (NRCS, 1998; NRCS 2002), especially in average to above average rainfall years. Any

increased military training activities or lack of military deferment on these areas would slow the recovery of vegetation that is expected due to the deferment of grazing in these areas. Vegetation inventories should be conducted during the deferment period to monitor changes in rangeland health and to assess whether grazing could be re-initiated to remove vegetation residue and reduce risk of wildfire.

Under this alternative, grazing in the North Fort Hood management unit would be conducted using stocking rates that maintain a 750 lbs/ac residue threshold. This would most likely lead to maintenance of current conditions. In areas having perennial herbaceous vegetation already below the maintenance threshold this alternative would likely lead to a slight increase in rangeland health. Military activities are generally light in this area, so the combination of grazing and military activities should not lead to further declines in rangeland health and condition. Also, the probability of wildfires should not increase since at least 1,000 lbs/ac of continuous fine fuel is required to carry a fire.

Under this alternative, the northern portion of West Fort Hood would be grazed using stocking rates determined with 25 percent Harvest Efficiency method. Since the majority of ecological sites within this management unit are already in good ecological condition, grazing under this stocking rate should not lead to a decline in rangeland health. However, this stocking rate should be reassessed if drought conditions occur and/or military activities increase in this area.

In the Live Fire Area, the maximum number of animal units that will be allowed to graze are 750 AU. Given the perennial grazeable vegetation resource in this management unit, the 750 animal units equates to a light stocking rate. Under this alternative, slight moderate increases in desired species would be expected and vigor would be increased in already established plants. In areas already in poor condition within this management unit, above average rainfall would most likely be required for an upward trend in ecological condition to occur. Portions of this management unit have high productivity, thus increasing the risk of wildfire. Fort Hood has an active prescribed burning program in this management unit to reduce the risk of range fires associated with military training. Therefore the risk of wildfire in this area should be minimal.

4.2.5.2 Fauna

Similar to the no grazing and reduced grazing intensity alternatives, range in good to excellent ecological condition is likely to have an increased abundance and diversity of faunal species. With a reduction in the stocking intensity on most grazing areas, and a brief deferment of grazing on others, the ecological condition of the range is expected to improve, potentially benefiting an array of fauna, including aquatic species. As discussed for the no grazing alternative, direct impacts of cattle on bird and other animal species is minimal unless stocking intensity is so high that animals or nests are trampled. The implementation of the INRMP actions, particularly the prescribed burning plan and the grazing management plan will allow managers to adjust actions to meet the needs of the species.

4.2.5.3 Threatened or Endangered Species

Implementing this alternative would have direct and indirect impacts on the golden-cheeked warbler and black-capped vireo. Deferring grazing in some areas likely would result in some degree of reduction in the number of cowbirds in those areas, and a resulting decrease in parasitism. However, deferring grazing in the Eastern Training Areas will result in the termination of the MOU with the CTCA that requires the CTCA to manage and support cowbird trapping on private lands adjacent to the Eastern Training Areas (USFWS, 1999). However, Fort Hood NRMB staff will continue implementation of the cowbird trapping program throughout the installation, thus maintaining parasitism rates at current levels. Termination of the MOU in this case could have a substantial impact on the working relationship between the CTCA and

Fort Hood. Though the termination of the MOU may impact the relationship among the associated agencies and individuals, the endangered species likely would not be impacted.

Reducing and closely managing grazing intensity throughout the installation would have beneficial indirect impacts on the golden-cheeked warbler and the black-capped vireo. These indirect impacts are similar to those discussed for Alternatives 1, 3 and 4, primarily resulting from improved ecological condition of the range.

Other protected or rare species will not likely be impacted by this alternative.

Biological Resources: Conclusion: Impacts to the flora and fauna under this alternative likely would be beneficial, assuming ecological condition of the range improves. Impacts to the golden-cheeked warbler and black-capped vireo likely would be mitigated with the cowbird trapping and shooting programs.

4.3 EARTH RESOURCES

Military training on Fort Hood is one of the primary causes of soil erosion on the site. Disturbances to soil from tracked and wheeled vehicles lead to churning and/or compaction of the soil, which leads to a loss of vegetative cover (Milchunas et al., 1999). The disturbance and loss of vegetation thus makes the soil more susceptible to losses from water erosion (Thurow, 1990). Recovery of the vegetation and the reduction in soil erosion is then dependent on the amount of time before the site is disturbed again. Grazing by livestock can slow the recovery of these sites because new growth on the vegetation is grazed before it can produce sufficient root systems to hold the soil and provide sufficient plant cover to reduce erosion.

Grazing, with or without military activities, can have significant impacts on soils (Milchunas et al., 1999). Grazing can increase soil compaction (Orodho et al., 1990; Trimble and Mendel, 1995), reduce water infiltration (Trimble and Mendel, 1995; Belsky and Blumenthal, 1997), and increase soil erosion (Lusby, 1970; Thurow, 1990; Trimble and Mendel, 1995; Belsky and Blementhal, 1997; Evans, 1998). The severity of the impact is generally driven by the grazing intensity, frequency, and duration. In a review of cattle grazing impacts on soils, Trimble and Mendel (1995) state that under "heavy grazing" (0.22 to 7.4 animal unit month (AUM)/ha, mean=2.5 AUM/ha) soils have increased compaction, reduced infiltration, increased runoff, and increased erosion and sediment yields. Under moderate (0.16 to 3.7 AUM/ha mean=1.2 AUM/ha) and light (0.17 to 1.5 AUM/ha mean=0.65 AUM/ha), the impacts described above were significantly less. Davenport et al., 1998, states that site erosion potential (a combination of climate, geomorphology, and soil erodibility) and ground cover are the primary factors influencing soil erosion. In their study of Pinyon-Juniper vegetation, they found that erosion rates on sites having a high site erosion potential were extremely sensitive to the amount of ground cover present. Once ground cover was reduced below a certain threshold, soil erosion increased substantially with small decreases in ground cover and this change in erosion rate was rapid and irreversible.

To assess impacts to soils for the five proposed alternatives, RUSLE 1.6 (Renard et al. 1997) was used to determine potential soil loss from water erosion. The RUSLE model was developed by the USDA, Agricultural Research Service (ARS) for assessing water erosion on a variety of land uses. RUSLE soil erosion estimates on rangelands have been compared to actual soil loss in an experimental setting. In a rainfall simulation study on rangeland near Tombstone, Arizona, Weltz et al. (1987) found that the model generally predicted the correct trends in soil loss, however, the model generally under-predicted actual soil erosion. In a study on rangelands in seven states in the western U.S., Renard and Simanton (1990) evaluated the ability of the RUSLE model to predict soil loss. Their results were similar to Weltz et al. (1987) in that the RUSLE model generally had predicted soil loss values that were less than the actual soil

loss measured at these sites. Despite these issues, the RUSLE model is accepted as a method for estimating soil loss, especially when examining relative comparisons between various soil treatments, management alternatives, and conservation practices. Though the NRCS does not use the RUSLE model in Texas for predicting erosion on rangelands, a number of other agencies do, including the Arizona Cooperative Extension Service (Jones, 2001); BLM; USACE; NRCS in New Mexico and Florida; and the U.S. Department of Interior-Office of Surface Mining, Reclamation, and Regulation.

The RUSLE model requires site-specific information on vegetation cover, climate, soil erodibility, slope characteristics and disturbance regime/history. The NRCS' Soil Survey Geographic (SSURGO) databases for Bell and Coryell counties were used to extract soil information for the individual soils analyzed within each management unit. Soil erosion estimates were conducted on individual soils within the management units that comprised a cumulative total of at least 50 percent of the land area. The 50 percent cumulative total was used in order to allow the major soils to be represented within each management unit. The acreage of individual soils within each management unit was determined by intersecting the SSURGO database map layer with the ecological site/management unit map layer using geographic information system software. The major soils were then identified using database software (Table 4-2).

Table 4-2. Major soil series within Grazing Management Units used for estimation of soil erosion within each management unit at Fort Hood. Acres, percent of the total acres and cumulative percent of total acres are provided for each soil within the management units

Grazing Management Unit	Soil Series Name	Component Acres	Total Acres	Percent of Total Acres in Unit	Cumulative Percent
Western Maneuver Area – North	Topsey	5,926		17	17
	Real	5,021		14	31
	Eckrant	3,867		11	42
	Slidell	2,820		8	50
Total		17,635	34,961		
Western Maneuver Area – South	Nuff	7,131		22	22
	Doss	6,639		21	43
	Real	5,033		16	58
Total		18,803	32,305		
West Fort Hood - North	Topsey	2,205		50	50
	Krum	813		18	68
Total		3,018	4,407		
West Forth Hood - South	Topsey	3,159		30	30
	Krum	1,075		10	40
	Tarrant	996		10	50
	Real	773		7	57
Total		6,004	10,471		
Eastern Training Area - North	Eckrant	8,302		30	30
	Real	3,844		14	44

Grazing Management Unit	Soil Series Name	Component Acres	Total Acres	Percent of Total Acres in Unit	Cumulative Percent
	Evant	1,794		6	50
Total		13,940	27,768		
Eastern Training Area - South	Evant	5,055		22	22
	Eckrant	4,414		19	42
	Krum	2,615		12	53
Total		12,085	22,678		
North Fort Hood	Bastsil	836		21	21
	Topsey	696		17	38
	Bosque	501		13	51
Total		2,033	3,993		
Live Fire Area	Topsey	14,073		23	23
	Real	8,256		14	37
	Doss	5,916		10	46
	Nuff	5,632		9	56
Total		33,878	60,887		

Plant biomass values are also required by the RUSLE model for estimation of soil erosion. In the comparison of alternatives, the plant biomass values used to parameterize the RUSLE model were derivations of the perennial consumable forage values from the May 2002 inventory that were used to calculate stocking rates for each of the alternatives. Perennial consumable forage was used because this is the component of the residue cover that is most impacted by grazing (e.g., perennial grasses), and it best reflects the management goals of residue thresholds for alternatives 3 and 4. Also, perennial consumable forage biomass was used in previous erosion estimates on the installation, thus allowing continuity with previous activities. Although other perennial vegetation was present on some of the ecological sites, this amount was generally less than 200 lbs/acre for the majority of the soils examined for erosion. The species comprising this biomass were generally forbs (e.g., ragweed, antelope-horns, and frog-fruit) that do not provide the same erosion protection as the perennial grasses. In addition, total perennial biomass was not collected in the Live Fire/Impact Area as visual estimates of the perennial consumable biomass were made. Therefore, the use of perennial consumable biomass allow comparison of all alternatives in all management units on the installation.

To ascertain the plant biomass values for each of the major soil types within the management units (Table 4-2) to be used for parameterizing the RUSLE model, the ecological site/management unit map layer containing the perennial consumable forage was intersected with the SSURGO soil map layer using geographic information system software. Plant biomass values were summarized by management unit and major soil type using area weighted averaging (i.e., in calculating the average biomass, biomass values were weighted proportionally to the amount of acres of the soil type within each management unit). When conducting soil erosion estimates in the RUSLE model for each of the major soil types within each management unit, the amount of plant biomass entered into the model was adjusted to reflect the expected forage residue on the grazing management units after grazing under each of the alternatives as follows:

- Alternative 1 – No Grazing: All of the perennial consumable biomass was entered.

- Alternative 2 – Standard Method: 50 percent of the perennial consumable biomass was entered to reflect that 50 percent of the vegetation remains as residue under this alternative.

- Alternative 3 – Maintenance Threshold: Actual perennial consumable biomass for sites having less than 750 lbs/ac, 750 lbs/ac for sites having between 750 and 1,500 lbs/ac, and 50 percent of the perennial consumable biomass for sites having greater than 1,500 lbs/ac.

- Alternative 4 – Conservation Threshold: Actual perennial consumable biomass for sites having less than 1,000 lbs/ac, 1,000 lbs/ac for sites having between 1,000 and 2,000 lbs/ac, and 50 percent of the biomass for sites having greater than 2,000 lbs/ac.

- Alternative 5 – Combined alternative: Actual perennial consumable biomass for soils within the Western Maneuver Area, Eastern Training Area and the southern portion of West Fort Hood. 750 lbs/ac for North Fort Hood. 50 percent of the perennial consumable biomass for the northern portion of West Fort Hood. 80 percent of the perennial consumable biomass for the Live Fire Area was entered (the 750 AUs limit in the Live Fire Area equates to a 10 percent harvest efficiency in this management unit, therefore the amount actually removed by the grazing animal is 20 percent, with 80 percent of the vegetation remaining as residue).

Once soil erosion estimates were determined for each of the major soils within the management units (Table 4-2), the area weighted averaging approach was used to determine the average amount of potential soil erosion within the management units for each of the alternatives. This was accomplished by multiplying the RUSLE estimated soil erosion by the number of acres for each soil type. These numbers were then summed within the management unit and divided by the total number of acres of the major soils. This provided a weighted average erosion estimate for each management unit under each alternative. The acceptable soil loss tolerances (soil T factor) for each of the major soils were also subjected to area weighted averaging so that an average acceptable soil loss for each management unit could be identified. For each of the various alternatives, the average potential soil erosion within a management unit was divided by the average acceptable soil loss to calculate a significance factor. Alternatives having Significance Factors exceeding 1.0 were considered to have significant impacts, meaning that if the expected rate of erosion was greater than what was deemed acceptable for the soils in the unit, the impacts would be significant (presented in Table 4-3 in Section 4.3.1.1). It should be noted that RUSLE estimates of water erosion under the alternatives reflect potential sediment yield given the plant biomass, soil erodibility, and landscape attributes used to parameterize the model (Appendix B) and are used here to allow a relative comparison of soil erosion under each of the alternatives as they are influenced by cattle grazing. Effects of the combination of cattle grazing and increased military activities were not analyzed.

4.3.1 Alternative 1, No Grazing Alternative

4.3.1.1 Soils

Under this alternative, grazing would be deferred across the entire installation. However, because of the conditions of low perennial biomass in the Eastern Training Area, the Western Maneuver Area, and the southern portion of West Fort Hood, significant erosion is estimated to occur even under this alternative (Table 4-3). Erosion is estimated to be 4.13 tons/ac/year for the northern portion of the Eastern Training Area and 3.10 tons/ac/year for the southern portion of this area (Table 4-3). This is 2.94 times the tolerable limits for the northern portion and 1.36 times the tolerable limits for the southern portion. In the

Western Maneuver Area, erosion is estimated to be 4.73 tons/ac/year for the northern portion and 5.10 tons/ac/year for the southern portion (Table 4-3). These exceed tolerable limits by approximately 1.5 times.

Table 4-3. Acceptable soil loss tolerances (T), potential average annual erosion rates (A) (tons/ac/year) from the RUSLE 1.6 erosion prediction model, and significance factor (A/T) for Grazing Management Units for each of the alternatives

Management Units [a]	Acceptable Soil Loss (T) (tons/ac/yr)	Alternative 1 No Grazing		Alternative 2 25% Harvest Efficiency		Alternative 3 Maintenance Threshold		Alternative 4 Conservation Threshold		Alternative 5 Combined Approach (Preferred Alt.)	
		Erosion (A)	Sign. Factor (A/T)[b]	Erosion (A)	Sign. Factor (A/T)	Erosion (A)	Sign. Factor (A/T)	Erosion (A)	Sign. Factor (A/T)	Erosion (A)	Sign. Factor (A/T)
WMA-North	3.27	4.73	1.45	6.87	2.10	5.19	1.59	4.76	1.46	4.73	1.45
WMA-South	3.14	5.10	1.62	6.51	2.07	5.10	1.62	5.10	1.62	5.10	1.62
WFH-North	5.00	1.19	0.24	4.22	0.84	4.22	0.84	4.17	0.83	4.22	0.84
WFH-South	3.95	4.81	1.22	7.10	1.80	4.81	1.22	4.81	1.22	4.81	1.22
ETA-North	1.40	4.13	2.94	4.89	3.48	4.13	2.94	4.13	2.94	4.13	2.94
ETA/South	2.28	3.10	1.36	3.47	1.52	3.10	1.36	3.10	1.36	3.10	1.36
NFH	2.94	1.72	0.58	3.37	1.15	2.89	0.98	2.30	0.78	2.30	0.78
LFI	3.74	3.02	0.81	5.92	1.58	5.12	1.37	4.37	1.17	3.72	0.99

[a] WMA-North North portion of the Western Maneuver Area
WMA-South South Portion of the Western Maneuver Area
WFH-North North portion of West Fort Hood
WFH-South South portion of West Fort Hood
ETA-North North portion of the Eastern Training Area
ETA/South South portion of the Eastern Training Area
NFH North Fort Hood
LFI Live-Fire and Impact Areas

[b] The "significance factor" refers to the ratio of the potential erosion rate (A) to the acceptable soil loss (T). Any value above 1.0 is considered to be a significant impact. Specific variables for each of the soils and management units used are given in Appendix B.

As discussed previously (see Section 3.3.1), monitoring of soil erosion for the Land Condition and Trend Analysis was conducted in 2001 and the results indicated that soil loss was greater than acceptable rates on 72 percent of the sites inventoried in the Western Maneuver Area and 42 percent of the sites in the Eastern Training Area. They attributed the high amounts of erosion to the large amount of bare ground and low amounts of vegetation residue on the soil surface (NRCS, 2002). Average soil loss was estimated to be 6.0 tons/ac/year for the Western Maneuver Area with a range of 0.1 to 25.1 tons/ac/year and 2.0 tons/acre/year with a range of 0 to 7.8 tons/ac/year in the Eastern Training Area. In the West Fort Hood grazing management unit, soil erosion average 0.7 tons/ac/year with a range of 0.1 to 3.0 tons/ac/year.

Erosion estimates developed for this SEA are comparable with the previous erosion estimates, however, the estimates were slightly higher for the Eastern Training Area and slightly lower for the Western Maneuver Area (Table 4-3). Differences in these estimates may be related to the site by site analysis done by NRCS versus the area-weighted approach used in this SEA. However, erosion estimates for the

SEA fall within the range of those reported previously for the Western Maneuver area and Eastern Training area. Estimates for West Fort Hood were higher than those reported in the 2001 assessment.

Under this alternative, deferment of grazing in the Western Maneuver Area and Eastern Training Area would likely result in a recovery of the vegetation communities allowing perennial herbaceous plant production and vigor to increase and the amount of plant residue to increase. Over time, soil erosion would likely decrease to tolerable limits with continued deferment. However, any increase in military activities on sites already having erosion exceeding tolerable limits would likely lead to continued erosion and declining rangeland condition. As stated previously, areas within these management units may require reseeding, brush removal, and revegetation to accelerate the process of upward rangeland trend and to provide the perennial herbaceous cover to protect the soil. Each of these activities will lead to soil disturbance, therefore erosion protection measures should be considered to insure that erosion revegetated sites do not exceed tolerable limits.

Erosion is estimated to be within tolerable limits under this alternative in the Live Fire Area, North Fort Hood, and in the northern portion of West Fort Hood. Deferment of grazing would allow perennial herbaceous plant production and vigor to increase in these areas leading to further decreases in soil erosion.

Soils: Conclusion: Given adequate rainfall and no increases in military activities, it is likely that vegetation in all areas would recover sufficiently to provide adequate ground cover to cause erosion to fall within acceptable tolerance limits, thus leading to impacts that would not be significant over time.

4.3.1.2 Geological Resources

This proposed alternative will not substantially impact geological resources. Grazing activities will not impact extraction of mineral resources (topsoil, gravel, sand, and roadbase) and will generally not increase weathering of geologic strata.

4.3.2 Alternative 2, 25 percent Harvest Efficiency

4.3.2.1 Soils

Under this alternative, soil erosion is estimated to have significant impacts in all management units except the northern portion of West Fort Hood (Table 4-3). Under this alternative, approximately half of the perennial herbaceous vegetation remains after grazing. In areas where perennial vegetation biomass is already low, grazing will lead to further removal of this vegetation, which leads to higher estimated erosion losses because the soil does not have adequate protection. Estimated erosion was calculated to be the highest in the northern portion of the Eastern Training Area (4.89 tons/ac/year), which is 3.48 times the tolerable limits for the soils. In the Western Maneuver Area, erosion was estimated to be 6.87 tons/ac/year for the northern portion and 6.51 tons/ac/year for the southern portion. Each area is estimated to have approximately double the acceptable soil losses for these areas (Table 4-3).

This alternative does not allow adequate recovery of the vegetation resource in areas where rangeland condition has already deteriorated, thus it is expected to lead to continued increases in soil erosion over time. As stated previously, the 25 percent Harvest Efficiency method does not allow sufficient vegetation to be left after grazing as residue for protection from soil erosion on sites that are currently in poor condition and does not take into consideration forage lost through military activities. As discussed in Section 4.2.2, the 25 percent Harvest Efficiency method has been used to calculate stocking rates on the site since at least 1996. Since that time, erosion rates have been documented to exceed tolerable limits and rangeland health has declined in both the Western Maneuver Area and Eastern Training Area. Under

this alternative, the stocking rate for the installation would be 4,021 AUs compared to the 3,500 AUs allowed to graze from 1996 to 2002. Based on historical trends at the site and with the current levels of military training in the Western Maneuver Area and Eastern Training Area, there is no evidence that any improvement in rangeland health and condition would occur in these areas that would lead to reduced erosion. Therefore, it is expected that this alternative would lead to significant impacts to soils in these management units and lead to soil losses exceeding tolerable limits in the other management units except for the northern portion of West Fort Hood.

Soils: Conclusion: Given past history and estimates of erosion under current conditions, sufficient evidence exists that this alternative will have significant impacts on the soil resource. Also, any increase in military activities over time will likely lead to further decline in the rangeland health and an increase in soil erosion.

4.3.2.2 Geological Resources

This proposed alternative will not substantially impact geological resources. Grazing activities will not impact extraction of mineral resources (topsoil, gravel, sand, and roadbase) and will generally not increase weathering of geologic strata.

4.3.3 Alternative 3, Maintenance Threshold

4.3.3.1 Soils

Under this alternative, grazing was estimated to have significant impacts on soil resources in all management units except North Fort Hood and the northern portion of West Fort Hood (Table 4-3). Predicted erosion in the Eastern Training Area, Western Maneuver Area, the Live Fire Area, and the southern portion of West Fort Hood management units are 1.2 to 2.9 times the tolerable limits for soils in those areas (Table 4-3). Because stocking rates under this alternative are calculated assuming areas with perennial herbaceous vegetation already below the maintenance threshold of 750 lbs/ac do not contribute to "available forage" (e.g., the majority of ecological sites within the Western Maneuver Area and the Eastern Training Area), this alternative would likely lead to a slight improvement in rangeland health in those areas. However, given the already poor condition of these sites, and the fact that these sites cannot be segregated and protected from grazing by cattle allowed in the unit, years of above average rainfall would most likely be required before any significant increase in perennial vegetation biomass would be able to reduce erosion on these sites. Under this alternative, the maintenance threshold would have to be maintained both from a grazing and military activity standpoint. Increased military activities that would lead to a reduction in vegetation below the maintenance threshold would reduce any positive effects that this stocking rate would have on perennial vegetation and ecological condition, thus leading to increases in erosion over the estimated amounts.

Soils: Conclusion: Given past history and estimates of erosion under current conditions, sufficient evidence exists that this alternative will have significant impacts on the soil resource. Also, any increase in military activities over time will likely lead to further decline in the rangeland health and an increase in soil erosion.

4.3.3.2 Geological Resources

This proposed alternative will not substantially impact geological resources. Grazing activities will not impact extraction of mineral resources (topsoil, gravel, sand, and roadbase) and will generally not increase weathering of geologic strata.

4.3.4 Alternative 4, Conservation Threshold

4.3.4.1 Soils

Soil erosion estimates for management units under this alternative indicate that significant impacts to soils would result in the Eastern Training Area, Western Maneuver Area, the Live Fire Area, and the southern portion of West Fort Hood (Table 4-3). Soil erosion estimates in these areas ranged from 3.10 to 5.10 tons/ac/year, which are 1.2 to 2.9 times acceptable tolerance limits for those areas. In the North Fort Hood and the northern portion of West Fort Hood management units, erosion was within tolerable limits (Table 4-3).

The implementation of this alternative would most likely lead to a slight to moderate improvement in herbaceous perennial vegetation conditions, thus reducing erosion over time. In areas having perennial herbaceous vegetation already below the conservation threshold (e.g., the majority of ecological sites within the Western Maneuver Area and the Eastern Training Area) this alternative would likely lead to a slight increase in desired species and increased vigor in already established plants. However, given the already poor condition of these sites, above average rainfall would most likely be required for any substantial improvement in ecological condition. Under this alternative, the conservation threshold would have to be maintained for both grazing and military activities. Increased military activities that would lead to a reduction in vegetation below the conservation threshold would reduce any positive effects that this stocking rate would have on perennial vegetation and ecological condition.

Soils: Conclusion: Given past history and estimates of erosion under current conditions, sufficient evidence exists that this alternative will have significant impacts on the soil resource. Also, any increase in military activities over time will likely lead to further decline in the rangeland health and an increase in soil erosion.

4.3.4.2 Geological Resources

This proposed alternative will not substantially impact geological resources. Grazing activities will not impact extraction of mineral resources (topsoil, gravel, sand, and roadbase) and will generally not increase weathering of geologic strata.

4.3.5 Alternative 5, Combined Approach

4.3.5.1 Soils

Under this alternative, ecological health indices and erosion estimates indicate that significant impacts to soils would occur in the Western Maneuver Area, Eastern Training Area, and the southern portion of West Fort Hood management units, as discussed under the No Grazing Alternative (Table 4-3). However, grazing will be deferred in these management units, therefore grazing will not have a contributing effect to soil erosion in these areas under implementation of this alternative. Deferment of grazing in these management units will allow the vegetation to recover given adequate precipitation, thus increasing ground cover to reduce erosion. However, any increases in military activities will reduce any benefits of grazing deferment and lead to increased erosion in these management units. Implementation of the ITAM out-area program would allow areas within the Western Maneuver Area and Eastern Training Area to have periodic deferment from military activities, thus allowing vegetation to recover and provide protection of the soil from erosion.

The North Fort Hood, Live Fire Area, and the northern portion of West Fort Hood have soil erosion estimates that fall within the tolerable limits under this alternative (Table 4-3). However, at the 750 AU

limit imposed due to impacts to training, the predicted soil erosion resulted in a Significance Factor of 0.99 which was only slightly below the threshold of 1.00 that is used for considering grazing deferment. Therefore if a higher limit had been placed on the area, grazing may heve been defered for a year. Slight to moderate increases in ecological condition would be expected in these areas given average to above average rainfall conditions, thus leading to reduced erosion over time. However, any increase in military activities in these areas, especially in the Live Fire Area, could lead to erosion exceeding tolerable limits.

Soils: Conclusion: Given average to above average rainfall, annual adjustments to stocking rates based on forage inventories, and no increases in military activities, it is likely that vegetation and rangeland health on the range areas would recover sufficiently over time under this alternative. The increase in herbaceous perennial biomass and cover in areas where grazing is deferred would most likely result in erosion rates reduced within acceptable tolerance limits over time, therefore no significant impacts from grazing under this alternative are expected.

4.3.5.2 Geological Resources

This proposed alternative will not substantially impact geological resources. Grazing activities will not impact extraction of mineral resources (topsoil, gravel, sand, and roadbase) and will generally not increase weathering of geologic strata.

4.4 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Assessment of regional socioeconomic impacts resulting from the alternatives proposed considered the following:

- Potential economic impact of discontinuing or limiting cattle grazing on Fort Hood;
- Potential social impacts of continued grazing under alternatives; and
- Potential environmental justice impacts of continued grazing under alternatives.

There are no adverse social impacts due to any of the proposed alternatives.

No environmental justice impacts related to any of the proposed alternatives are expected since individual resource area impacts described throughout this chapter do not disproportionately affect minority or low-income populations due to the nature of the proposed action and alternatives. Economic impacts will not be disproportionate because the action affects only a small proportion of regional farm production costs incurred by all producers and since any future leases will be competed using full and open competitive governmental procurement procedures.

Because economic impacts are evaluated at a regional scale, not the associated individuals, the most significant economic impacts related to the grazing outlease program are likely to occur under Alternative 1, the No Grazing Alternative. The potential economic impacts of not renewing the grazing lease can be evaluated by assessing the proportion of cattle potentially produced on the installation compared to the market in the region. Together, the three counties most likely affected by the outlease program on the installation produced 151,000 cattle and calves in 2002: Bell (47,000); Coryell (68,000); and Lampasas (36,000) (USDA, National Agricultural Statistics Service, 2003). Assuming the lessee of installation property produced and sold 4,200 cattle each year (under Alternative 2), which would be slightly less than 3 percent of the production in these three counties. Therefore, if the acreage leased on Fort Hood could not be leased elsewhere on the private land market, the loss of that production would have little effect on the regional economy. The one-time sale of the cattle when removed from the

installation would likewise have no noticeable effect on the economy. Because the grazing systems used to date have been "cow-calf" operations, substantially less than 3,500 animals are produced from the area each year. Regional socioeconomic impacts of not grazing on Fort Hood would be minimal. Similarly, impacts from grazing at the maximum production under Alternative 2 would be minimal.

4.5 CULTURAL RESOURCES

Cultural resources are subject to review under both federal and state laws and regulations. Section 106 of the *National Historic Preservation Act* (NHPA) of 1966 empowers the State Historic Preservation Office(r) (SHPO) to comment on federally initiated, licensed, or permitted projects affecting cultural sites listed or eligible for listing on the NRHP. Impacts to cultural resources determined to be eligible or potentially eligible for the NRHP must be considered by federal agencies during the course of their undertakings. Impacts are assessed by identifying the types and locations of a proposed activity and determining the location of cultural resources that could be affected.

Impacts to cultural resources can include ground-disturbing actions such as military training, construction, vandalism, and other land uses that physically alter, damage, or destroy all or part of a resource. Livestock grazing, and subsequent erosion, can also impact cultural resources under certain circumstances (c.f. Osburn et al., 1987; Nickens, 1990; Trimble, 1995). At Fort Hood, grazing has been found to have minimal effects on cultural resources when compared to other effects. A treatment plan for prehistoric sites at Fort Hood (U.S. Army, 1999a) found that:

> "Livestock grazing has impacted sites in the past and may continue to threaten them in the future. Cattle movement, overgrazing, and reseeding of specific areas are potential impacts, but the extent of these threats is not fully known. Relative to other modern impacts, however, damage to archeological sites by livestock is minimal."

4.5.1 Alternative 1, No Grazing

This alternative would allow the existing grazing lease to expire and would not implement a new lease. Although livestock grazing has not been identified as a source of significant impacts to cultural resources at Fort Hood (U.S. Army, 1999a), removal of grazing could have a minor beneficial effect by decreasing the potential for future archeological site erosion and direct impacts from livestock.

4.5.2 Alternative 2, 25 percent Harvest Efficiency

This alternative is comparable to the current grazing outlease program at Fort Hood. Grazing would be permitted in all training and maneuver areas on the installation, except those areas that are fenced for the protection of various resources. No direct significant impacts to cultural resources are expected under this alternative because, under the current program, livestock grazing has not been identified as a source of significant impacts to cultural resources at Fort Hood when compared to other sources of impacts (U.S. Army, 1999a). However, with the potential increase in soil erosion from continuous grazing at relative high stocking rates, significant impacts could result from exposure and erosion of archaeological and cultural artifacts.

4.5.3 Alternative 3, Maintenance Threshold

Under this alternative, grazing would be permitted at a substantially reduced intensity in all training and maneuver areas on the installation, except those areas that are fenced for the protection of various resources. No direct significant impacts to cultural resources are expected under this alternative because,

under the current program, livestock grazing has not been identified as a source of significant impacts to cultural resources at Fort Hood when compared to other sources of impacts (U.S. Army, 1999a). However, with the potential for continued soil erosion in some areas from continuous grazing, significant impacts could result from exposure and erosion of archaeological and cultural artifacts.

4.5.4 Alternative 4, Conservation Threshold

Under this alternative, grazing would be permitted at a substantially reduced intensity in all training and maneuver areas on the installation, except those areas that are fenced for the protection of various resources. No direct significant impacts to cultural resources are expected under this alternative because, under the current program, livestock grazing has not been identified as a source of significant impacts to cultural resources at Fort Hood when compared to other sources of impacts (U.S. Army, 1999a). However, with the potential for continued soil erosion in some areas from continuous grazing, significant impacts could result from exposure and erosion of archaeological and cultural artifacts.

4.5.5 Alternative 5, Combined Strategy

Under this alternative, grazing would be permitted at a substantially reduced intensity in training areas where soil erosion would not be significant, and deferment of grazing in other areas until the vegetation is reestablished. No direct significant impacts to cultural resources are expected under this alternative because, under the current program, livestock grazing has not been identified as a source of significant impacts to cultural resources at Fort Hood when compared to other sources of impacts (U.S. Army, 1999a). Because grazing is deferred to allow vegetation to recover and reduce erosion, exposure and erosion of archaeological and cultural artifacts is not likely to occur.

4.6 WATER RESOURCES

Assessment of impacts on water resources resulting from the proposed alternatives considered the following:

- Potential effect of cattle grazing on surface water quality at Fort Hood and subsequently at Lake Belton; and

- Potential effect of cattle grazing on groundwater quality in the Fort Hood area.

Available information for the Fort Hood area regarding soil erosion and subsequent water quality degradation is concentrated on the effect of military vehicle use. However, it appears that the cumulative impact of cattle grazing and military vehicle use, or the effect of cattle grazing without the additional impact of military use has not been studied in detail at Fort Hood. There have been numerous studies performed indicating the effect of cattle grazing on soil condition and erosion in semi-arid regions. Most studies indicate that managed grazing can be allowed in these areas as long as "Best Management Practices" are implemented to reduce soil erosion caused by overgrazing or overtraining. Based on the limited information available specific to Fort Hood, nothing indicates that cattle grazing directly contributes significantly to declining surface water quality at Fort Hood and subsequently Lake Belton. However, results from studies in similar environments conclude that cattle grazing contributes to declining surface water quality if not managed properly. The NRCS, in their inventory of the vegetation resources in 1997 reported declining ecological condition on the majority of the eastern and western regions of Fort Hood, evidence of overgrazing by livestock, and they stated that they believed animal numbers in the past had exceeded contractual agreements (NRCS, 1998).

As described in Section 3.6.2, water quality data from 2002 for the Cowhouse Creek, Leon River, and the Lampasas River indicate that grazing on the installation has made limited contributions to the increase in fecal coliform in the water system of the Brazos River Basin, despite the relatively high stocking rates in the past and the excessive soil erosion.

No substantial impacts to ground water quality in the Fort Hood area are expected as a result of cattle grazing.

4.6.1 Alternative 1, No Grazing Alternative

Surface water quality should improve due to discontinued cattle grazing on Fort Hood. Lack of grazing on areas denuded by tracked vehicles will aid in the re-establishment of vegetation and reducing the potential for soil erosion, thus reducing sediment loads from these areas. This would also help to determine the cumulative effects of cattle grazing and military vehicle use on soil erosion and subsequent water quality degradation. The implementation of an ongoing Fort Hood sediment monitoring project (by Blackland Research Center) would be able to identify water quality improvements due to revegetation and discontinued cattle grazing. Full implementation of the *Soil Erosion Management Plan* and a Water Quality Program, as described in the INRMP (U.S. Army, 2000), would also assist in alleviating these water quality impacts.

4.6.2 Alternative 2, 25 percent Harvest Efficiency

Continued cattle grazing at the levels proposed in Alternative 2 may continue to have an impact on surface water quality due to overgrazing and subsequent soil erosion. However, this impact is not easily quantifiable because there is a lack of data regarding the effects on surface water due to cattle as opposed to effects due to military vehicle maneuvers. Implementation of the *Soil Erosion Management Plan* and a Water Quality Program, as described in the INRMP (U.S. Army, 2000), would also assist in alleviating these water quality impacts.

4.6.3 Alternative 3, Maintenance Threshold

Impacts to water quality resulting from sedimentation should improve under this alternative due to reduced grazing pressure, and the anticipated improvement in ecological health of the area and increased vegetation, resulting in reduced run-off and increased infiltration. Full implementation of the *Soil Erosion Management Plan* and a Water Quality Program, as described in the INRMP (U.S. Army, 2000), would also assist in alleviating these water quality impacts.

4.6.4 Alternative 4, Conservation Threshold

Impacts to water quality resulting from sedimentation should improve substantially under this alternative due to reduced grazing pressure, and the anticipated improvement in ecological health of the area and increased vegetation, resulting in reduced run-off and increased infiltration. Full implementation of the *Soil Erosion Management Plan* and a Water Quality Program, as described in the INRMP (U.S. Army, 2000), would also assist in alleviating these water quality impacts.

4.6.5 Alternative 5, Combined Strategy

Impacts to water quality resulting from sedimentation should improve at varying rates in the various grazing units based on the management strategy associated with the area. Since all strategies are intended to minimize soil erosion and improve ecological health of the area, reduced run-off and increased infiltration should result from this alternative. Full implementation of the *Soil Erosion Management Plan*

and a Water Quality Program, as described in the INRMP (U.S. Army, 2000), would also assist in alleviating these water quality impacts.

4.7 NOISE

Assessment of impacts on noise resulting from the proposed alternatives considered the potential effect of continued cattle grazing to noise production and elevation.

There are no impacts to noise production and noise elevation at Fort Hood or adjacent lands resulting from any of the proposed alternatives.

4.8 AIR QUALITY

Assessment of impacts on air quality resulting from the proposed alternatives considered the following:

- Potential effect of continued cattle grazing on air quality on Fort Hood and in the surrounding air shed; and

- Potential effect of continued cattle grazing on attainment status on Fort Hood and in the surrounding air shed.

There are no impacts to air quality at Fort Hood or adjacent lands resulting from any of the proposed alternatives.

4.9 UTILITIES

Assessment of impacts on utilities resulting from the proposed alternatives considered potential effect of continued cattle grazing on use of utility services (i.e. gas, sewer, electricity) at Fort Hood.

There are no impacts to utilities at Fort Hood or adjacent lands resulting from any of the proposed alternatives.

4.10 TRANSPORTATION

Assessment of impacts on transportation resulting from the proposed alternatives considered the potential effect of continued cattle grazing on traffic at Fort Hood.

During the period of January 1, 1997, through March 31, 2000, 54 accidents occurred due to collisions with animals on Fort Hood, 53 involved cattle. All 54 resulted in property damage, 7 resulted in injury. No cost data related to these accidents was available at the time of this analysis. To evaluate the risk of accidents under the proposed alternatives, the number of accidents per year under current grazing intensity was calculated as the number of cattle-involved accidents (53) divided by the number of years data were collected (3.25 years) resulting in 16.3 accidents per year, at a stocking rate of 3,500 AUs, assuming a linear relationship between stocking rate and accident frequency (Table 4-4).

Increased stocking rates under the Alternative 2 would result in a slight increase in the number of annual cow/vehicle accidents, and all of the other alternatives would result in a reduction in accidents.

Table 4-4. Cow/Vehicle Accidents Under the Proposed Alternatives

		Alternatives				
	Current Lease	*1 No Grazing*	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined Method*
Stocking Rate	3,500	0	4,021	2,686	2,291	1,100
Percent of Current Grazing	100	0	115	77	65	31
Annual Cattle/vehicle accidents	16.3	0	18.7	12.6	10.6	5.1

4.11 HAZARDOUS MATERIALS AND ITEMS OF SPECIAL CONCERN

Assessment of impacts on hazardous materials and items of special concern resulting from the alternatives proposed considered the following:

- Potential effect of continued cattle grazing at various levels to the use of hazardous materials or other items of special concern; and

- Potential effect of discontinued cattle grazing to the use of hazardous materials or other items of special concern.

There are no impacts to hazardous materials use at Fort Hood resulting from any of the proposed alternatives.

5.0 CUMULATIVE IMPACTS AND IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS

Each resource or group of resources evaluated for potential impacts from the alternatives were also evaluated from the standpoint of impacts that might be cumulative with past, present, or reasonably foreseeable projects or activities on the installation or within the region. Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects the use of these resources may have on future generations. Irreversible effects primarily result from use or destruction of specific resources that cannot be replaced within a reasonable time frame (e.g., energy and minerals). Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., disturbance of a cultural site).

Impacts from implementing none of the grazing alternatives would have impacts on *Land Use, Air Space Use,* or *Visual Resources* that would be cumulative with impacts from past, current, and reasonably foreseeable future activities. Implementing the grazing alternatives would require a grazing outlease be entered into, but the lease and associated grazing plan would include text to allow the Army to withdraw the lease in the event the land needed to be used for incompatible military activities. Therefore, the preferred alternative would establish no irretrievable or irreversible commitments.

As discussed in Section 4.0, impacts to *Biological Resources* are expected to be cumulative with the military training activities that are the primary mission of the installation. However, implementing the preferred alternative (Alternative 5) or Alternative 1 (No Grazing), as well as implementing mitigative actions described in the INRMP, will allow the vegetative community in areas in poor condition to recover through grazing deferment. The cumulative impact of training activities in these areas will be minimized through the use of the "Out Area Program," where training is not allowed on certain training areas and restoration actions are implemented. Additionally, the rapidly expanding cowbird trapping program, managed by TPWD, will further reduce the cowbird abundance and its influence on the endangered bird species in the region. Development and urban expansion in the region have resulted in the loss of habitat for numerous species including the endangered Golden-cheeked warbler and Black-capped vireo, but implementing the preferred alternative and the mitigation actions in the INRMP will result in improved habitat for these species. No other cumulative impacts on biological resources have been identified. No irretrievable or irreversible commitments related to biological resources were identified.

As discussed in Section 4.0, impacts on *Earth Resources*, particularly soils, are expected to be cumulative with the military training activities that are the primary mission of the installation. However, implementing the preferred alternative (Alternative 5) or Alternative 1 (No Grazing), combined with implementation of the conservation and management actions in the INRMP and other management plans, will reduce these impacts by reducing soil compaction, enhancing infiltration rates, and allowing vegetative communities to recover in all or many areas where erosion has been severe. No cumulative impacts from off-site activities were identified. Continued grazing at stocking rates comparable to those of the past or in Alternative 2 could lead to irretrievable or irreversible losses and commitments of earth resources, particularly soil, due to the slow recovery rates of the shallow soils in some areas.

No impacts associated with *Socioeconomic* or *Environmental Justice* impacts or resources were found to be cumulative with past, present, or reasonably foreseeable future activities on the installation or in the region. No irretrievable or irreversible commitments related to Socioeconomic or Environmental Justice issues were identified.

No impacts to *Cultural Resources* are expected to be cumulative with past, present or reasonably foreseeable future activities on the installation or in the region. Implementing the preferred alternative or

Alternative 1 and the conservation measures in the INRMP will allow improvement in vegetative cover and reduce erosion, minimizing future exposure of artifacts. All other activities on the installation are required to avoid areas with significant cultural resources. No irretrievable or irreversible commitment related to cultural resources were identified.

As discussed in Section 4.0, impacts to *Water Resources* may be cumulative with military training activities that are the primary mission of the installation. These impacts may result from the continued severe soil erosion, but implementing the preferred alternative or Alternative 1, with implementation of the soil conservation and water quality plans will significantly reduce these impacts. No other cumulative impacts were identified. No irretrievable or irreversible commitments related to water resources were identified.

No impacts associated with *Noise* impacts or resources were found to be cumulative with past, present, or reasonably foreseeable future activities on the installation or in the region. No irretrievable or irreversible commitments related to noise were identified.

No impacts associated with *Air Quality* impacts or resources were found to be cumulative with past, present, or reasonably foreseeable future activities on the installation or in the region. No irretrievable or irreversible commitments related to air quality were identified.

No impacts associated with *Utilities* impacts or resources were found to be cumulative with past, present, or reasonably foreseeable future activities on the installation or in the region. No irretrievable or irreversible commitments related to utilities were identified.

No impacts associated with *Transportation* impacts or resources were found to be cumulative with past, present, or reasonably foreseeable future activities on the installation or in the region. No irretrievable or irreversible commitments related to transportation were identified.

No impacts associated with *Hazardous Materials and Items of Special Concern* impacts or resources were found to be cumulative with past, present, or reasonably foreseeable future activities on the installation or in the region. No irretrievable or irreversible commitments related to hazardous materials and items of special concern were identified.

6.0 LIST OF AGENCIES AND PERSONS CONSULTED

The following individuals and agencies were consulted on development of this SEA. The list will be expanded and further developed for the final document as agency reviews and comments are provided. Individuals contacted by the NRMB Staff will be incorporated for the final document. (Consultation letters are included in Appendix C).

Frederick, David C. Supervisor; U.S. Fish and Wildlife Service. Comments on Draft Environmental Assessment. Letter to Dennis Herbert, Directorate of Public Works, Dated 26 September 2000.

Graham, Gary. Director, Wildlife Division, Texas Parks and Wildlife Department. Comments on Draft Environmental Assessment. Letter to Dennis Herbert, Directorate of Public Works, Dated 26 September 2000.

Oaks, F. Lawrence. State Historic Preservation Officer, Texas Historical Commission. Project Review under Section 106 of the National Historic Preservation Act of 1966; Preparation of Environmental Assessment for Grazing Out-Lease. Letter to Deputy Director for Environmental Programs, III Corps and Fort Hood, Dated 14 July 2000.

Turney, Terry. Biologist, Wildlife Division, Texas Parks and Wildlife Department. Telephone conversation responding to questions on current cowbird trapping program throughout Texas. Conversation with D. Rakestraw on 14 January 2003.

7.0 LIST OF PREPARERS

The following individuals were primarily responsible for the content of the SEA or for providing senior management leadership during the development and production phases of this document.

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8.0 CONCLUSIONS OF FINDINGS

In accordance with Army Regulations, resource managers at Fort Hood have determined that excess forage is available in portions of the installation that would be available for use by livestock without impacting the training mission or natural resources. Therefore, the Department of the Army intends to make those resources available for livestock grazing through the Army's agricultural outlease program.

A total of five alternatives were evaluated as part of this SEA, one no grazing alternative and four grazing alternatives. These included the following:

1. No action: No outlease for grazing on the installation.

2. 25 percent Harvest Efficiency: Calculating a stocking rate for all Grazing Management Units each year using yearly inventories of available forage based on the standard NRCS approach to determining amount of forage available for cattle.

3. Maintenance Threshold: Calculating stocking rates for all Grazing Management Units each year using yearly inventories of available forage, and using an approach where 750 lbs/acre of consumable forage is left after grazing as residue.

4. Conservation Threshold: Calculating stocking rates for all Grazing Management Units each year using yearly inventories of available forage, and using an approach where 1,000 lbs/acre of consumable forage is left after grazing as residue.

5. Combination Strategy or Approach: Calculating stocking rates for each Grazing Management Unit each year using one of the strategies or approaches described for the three previous alternatives, with an option to defer grazing if erosion is predicted to be excessive. The specific strategy selected for each unit was based on best management strategies considering the condition of the range, other land uses for the unit, and potential for direct conflicts with training activities. A limit of 750 AUs is established in the Live Fire and Impact Areas to reduce training delays.

Preferred Alternative

Resource managers at Fort Hood selected the Combination Strategy (Alternative 5, Preferred Alternative in the SEA) to be the proposed alternative for this SEA. This alternative was selected for the following reasons:

- No significant impacts to the environment were identified,
- Maximized grazing in areas where ecological condition is good and erosion is minimal,
- Stocking rates would be adjusted at least annually based on the availability of the forage,
- Balances potential for grazing and need to control erosion, and
- Provides the Army increased ability to minimize training shutdowns due to cattle.

Non-Preferred Alternatives

Though no short-term significant impacts were identified for the "No Grazing" Alternative (Alternative 1), the potential for increased litter in areas that are ungrazed could lead to additional wild fires on and around the installation. Additionally, forage inventories show that areas on the installation have sufficient excess forage and these areas could support grazing and could be made available with no impacts to the training mission or the natural resources.

Analyses of each of the other three grazing alternatives (Alternatives 2, 3, and 4) indicate that grazing at the resulting stocking rates of those alternatives would result in erosion at levels greater than those identified as acceptable for the soil types in at least one of the Grazing Management Units. Significant levels of erosion leads to potential impacts to water quality through sediment loading, cultural resources through exposure of artifacts, continued decline in ecosystem health due to loss of preferred vegetation and adverse impacts to the training mission due to delays in the Live Fire and Impact Areas.

Conclusion

Based on the information and analyses presented in this SEA, the Proposed Action would not likely have significant adverse impacts on the quality or the integrity of the human or natural environments. Therefore, an *Environmental Impact Statement* will not be prepared for the Fort Hood Grazing Outlease Program.

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APPENDIX A

USE OF TRAINING AREAS

Appendix A. Use of the Training Range Areas on Fort Hood, Texas, by Number of Days Used and the Number of Personnel Using the Area between May 1, 1999 and April 30, 2000

Training Range Name	*Days Used*	*Number of Personnel*
Artillery Live Fire Area 01	16	3,400
Artillery Live Fire Area 02	4	1,200
Artillery Live Fire Area 03A	5	1,900
Artillery Live Fire Area 04	5	2,000
Artillery Live Fire Area 11	47	12,450
Artillery Live Fire Area 12	54	12,875
Artillery Live Fire Area 13A	26	7,475
Artillery Live Fire Area 13B	8	1,265
Artillery Live Fire Area 15A	57	12,400
Artillery Live Fire Area 36	13	1,950
Artillery Live Fire Area 36 East	3	825
Artillery Live Fire Area 42	58	12,885
Artillery Live Fire Area 43	2	350
Artillery Live Fire Area 44A	39	7,985
Artillery Live Fire Area 44B	9	1,625
Artillery Live Fire Area 44C	25	3,975
Artillery Live Fire Area 48	9	1,190
Artillery Live Fire Area 53	2	175
Artillery Live Fire Area 73	7	1,000
Air Load Simulator	26	1,189
Antelope Drop Zone	1	45
Brown's Creek Multiuse	181	26,534
Black Gap Pistol Qualification	177	13,639
Black Gap Record Bravo	159	18,446
Black Gap Record Charlie	199	24,389
Black Gap	71	10,196
Brookhaven Direct Fire	2	400
Brookhaven Mark 19	13	2,035
Brookhaven Multiuse	18	3,705
BMHGDA	14	1,680
BRHGQ	88	13,253
Blackwell Multiuse	201	27,466
Blackwell Pistol Alpha	78	6,065
Blackwell Pistol Bravo	31	1,779
Combat Bayonet Assault Course	8	2,160
Clabber Creek/Jack Mountain Complex	87	8,211
Clear Creek	18	4,081
Clear Creek Grenade Launcher	150	8,453
Clear Creek Machine Gun Alpha	44	2,041
Clear Creek Machine Gun Bravo	43	2,887
Clear Creek Multiuse	117	15,900
Clear Creek Rifle Alpha	171	21,591
Clear Creek Rifle Bravo	166	23,563
Clear Creek Zero	71	9,097
Cowhouse	4	400
Cowhouse Hellfire	18	834
Cowhouse Machine Gun	159	9,367
Curry Mortar Center	82	4,081

Appendix A. Use of the Training Range Areas on Fort Hood, Texas, by Number of Days Used and the Number of Personnel Using the Area between May 1, 1999 and April 30, 2000 (Continued)

Training Range Name	*Days Used*	*Number of Personnel*
Curry Mortar North	46	1,776
Crittenberger Multiuse	236	31,817
Curry Mortar South	56	2,723
Combat Systems NBC Chamber	72	11,372
Cold Springs Direct Fire	15	1,833
Cold Springs Mark 19	51	2,523
Curry Demolition	73	12,862
Dalton Mountain/Denson Mountain Complex	81	5,788
Dalton Mountain Multiuse	144	17,780
Elijah Company MOUT Facility	99	8,734
EWA3	1	200
EWA5B	1	10
EWA5E	1	11
Forward Area Refuel/Rearm Point 1	60	2,507
Forward Area Refuel/Rearm Point 2	146	8,320
Forward Area Refuel/Rearm Point 3	41	1,568
House Creek Assault Course	101	20,696
House Creek Squad Live Fire	42	7,130
Henson Mountain Multiuse	112	15,045
Hargrove Platoon MOUT Facility	97	16,172
Jack Mountain Multiuse	79	5,718
Land Group 01	2	230
Land Group 04	1	200
Leadership Reaction Course	97	7,871
Lone Star Multiuse	74	7,982
Multiple Launch Rocket System	2	240
Mortar Point 007	5	343
Mortar Point 008	25	1,115
Mortar Point 009	20	916
Mortar Point 015	3	95
Mortar Point 023	7	295
Mortar Point 024	5	155
Mortar Point 026	4	135
Mortar Point 100	16	104
NRD	7	467
Owl Creek Assault Course	96	15,773
Observation Point Jack Mountain	26	904
Observation Point Manning	6	155
Observation Point Maple	4	80
Observation Point McBride	2	65
Observation Point Phantom	61	1,806
Observation Point Robinette	2	30
Observation Point Round	13	140
Observation Point Trapnell	3	53
Permanent Dudded Area 94	3	30
Phantom Run	62	9,675
Pilot Knob AT4	51	3,424

Appendix A. Use of the Training Range Areas on Fort Hood, Texas, by Number of Days Used and the Number of Personnel Using the Area between May 1, 1999 and April 30, 2000 (Continued)

Training Range Name	*Days Used*	*Number of Personnel*
Pilot Knob Grenade Launcher	2	94
Pilot Knob Hand Grenade	93	13,100
Pilot Knob Mortar Sabot	29	1,030
Pilot Knob Multiuse	187	25,295
Pilot Knob Rifle Alpha	66	9,373
PKS	1	50
Pilot Knob Small Arms	62	7,924
Pilot Knob Sportsman	292	3,761
R6302A	359	11
R6302B	181	0
R6302C	352	0
R6302D	233	0
R6302E	357	0
Riggs Anti-Armor	74	3,819
Royalty Ridge Mark 19	66	4,475
Shoal Creek Bomb	24	166
SLF12	6	500
Sugar Loaf Multiuse	185	30,226
Training Area 10	3	150
Training Area 21	1	0
Training Area 27B	1	400
Trapnell Machine Gun	160	11,772
Trapnell Multiuse	202	28,434
WA2/A3	1	11
WDRAP	1	0

APPENDIX B

SOIL EROSION DATA

Table B-1. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Eckrant Soil in the Eastern Training Area – North Management Unit

Parameter	*Alternatives*				
	1 *No Grazing*	*2* *Standard Method*	*3* *Maintenance Threshold*	*4* *Conservation Threshold*	*5* *Combined (Preferred Alternative)*
R Factor Values					
R Factor	350	350	350	350	350
K Factor Values					
Estimated K	0.15	0.15	0.15	0.15	0.15
Rock Cover (percent)	43	43	43	43	43
Hydrologic Group	C	C	C	C	C
Texture	Silty clay	Silty clay	Silty clay	Silty clay	Silty clay
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	2.8	2.8	2.8	2.8	2.8
Segment Length (feet)	66	66	66	66	66
C Factor Values (Time Invariant)					
Production (pounds/acre)	219	109	219	219	219
Canopy Cover (percent)	10	7	10	10	10
Average Fall Height (feet)	1	0.5	1	1	1
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-2. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Real Soil in the Eastern Training Area – North Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	350	350	350	350	350
K Factor Values					
Estimated K	0.15	0.15	0.15	0.15	0.15
Rock Cover (percent)	5	5	5	5	5
Hydrologic Group	D	D	D	D	D
Texture	Clay Loam	Clay Loam	Clay Loam	Clay Loam	Clay Loam
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	13.6	13.6	13.6	13.6	13.6
Segment Length (feet)	30.1	30.1	30.1	30.1	30.1
C Factor Values (Time Invariant)					
Production (pounds/acre)	257	129	257	257	257
Canopy Cover (percent)	10	7.5	10	10	10
Average Fall Height (feet)	1	0.5	1	1	1
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-3. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Evant Soil in the Eastern Training Area – North Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	350	350	350	350	350
K Factor Values					
Estimated K	0.32	0.32	0.32	0.32	0.32
Rock Cover (percent)	1	1	1	1	1
Hydrologic Group	D	D	D	D	D
Texture	Silty clay	Silty clay	Silty clay	Silty clay	Silty clay
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	2	2	2	2	2
Segment Length (feet)	91	91	91	91	91
C Factor Values (Time Invariant)					
Production (pounds/acre)	314	157	314	314	314
Canopy Cover (percent)	12	8	12	12	12
Average Fall Height (feet)	0.5	0.5	0.5	0.5	0.5
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-4. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Evant Soil in the Eastern Training Area – South Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	338	338	338	338	338
K Factor Values					
Estimated K	0.32	0.32	0.32	0.32	0.32
Rock Cover (percent)	1	1	1	1	1
Hydrologic Group	D	D	D	D	D
Texture	Silty clay	Silty clay	Silty clay	Silty clay	Silty clay
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	2	2	2	2	2
Segment Length (feet)	91	91	91	91	91
C Factor Values (Time Invariant)					
Production (pounds/acre)	137	64	137	137	137
Canopy Cover (percent)	6	6	6	6	6
Average Fall Height (feet)	0.5	0.5	0.5	0.5	0.5
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-5. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Eckrant Soil in the Eastern Training Area –South Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	350	350	350	350	350
K Factor Values					
Estimated K	0.15	0.15	0.15	0.15	0.15
Rock Cover (percent)	43	43	43	43	43
Hydrologic Group	C	C	C	C	C
Texture	Silty clay	Silty clay	Silty clay	Silty clay	Silty clay
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	2.8	2.8	2.8	2.8	2.8
Segment Length (feet)	91	91	91	91	91
C Factor Values (Time Invariant)					
Production (pounds/acre)	103	51	103	103	103
Canopy Cover (percent)	7	6	7	7	7
Average Fall Height (feet)	1	0.5	1	1	1
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-6. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Krum Soil in the Eastern Training Area – South Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	332	332	332	332	332
K Factor Values					
Estimated K	0.32	0.32	0.32	0.32	0.32
Rock Cover (percent)	5	5	5	5	5
Hydrologic Group	D	D	D	D	D
Texture	Silty clay	Silty clay	Silty clay	Silty clay	Silty clay
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	2	2	2	2	2
Segment Length (feet)	91	91	91	91	91
C Factor Values (Time Invariant)					
Production (pounds/acre)	419	209	419	419	419
Canopy Cover (percent)	15	10	15	15	15
Average Fall Height (feet)	1	1	1	1	1
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-7. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Topsey Soil in the Live Fire Area Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	350	350	350	350	350
K Factor Values					
Estimated K	0.32	0.32	0.32	0.32	0.32
Rock Cover (percent)	3	3	3	3	3
Hydrologic Group	C	C	C	C	C
Texture	Clay loam	Clay loam	Clay loam	Clay loam	Clay loam
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	5.9	5.9	5.9	5.9	5.9
Segment Length (feet)	46	46	46	46	46
C Factor Values (Time Invariant)					
Production (pounds/acre)	1587	793	793	1000	1265
Canopy Cover (percent)	43	23	23	29	35
Average Fall Height (feet)	2	1.5	1.5	1.5	1.5
Roughness	1	1	1	1	1
Percent Ground Cover	18	4	4	10	14
Mechanical Disturbance?	No	No	No	No	No

Table B-8. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Real Soil in the Live Fire Area Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	350	350	350	350	350
K Factor Values					
Estimated K	0.15	0.15	0.15	0.15	0.15
Rock Cover (percent)	5	5	5	5	5
Hydrologic Group	D	D	D	D	D
Texture	Clay Loam	Clay Loam	Clay Loam	Clay Loam	Clay Loam
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	13	13	13	13	13
Segment Length (feet)	32	32	32	32	32
C Factor Values (Time Invariant)					
Production (pounds/acre)	726	363	726	726	581
Canopy Cover (percent)	22	13	22	22	18
Average Fall Height (feet)	1	1	1	1	1
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-9. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Doss Soil in the Live Fire Area Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	350	350	350	350	350
K Factor Values					
Estimated K	0.32	0.32	0.32	0.32	0.32
Rock Cover (percent)	5	5	5	5	5
Hydrologic Group	C	C	C	C	C
Texture	Silty clay	Silty clay	Silty clay	Silty clay	Silty clay
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	5	5	5	5	5
Segment Length (feet)	49	49	49	49	49
C Factor Values (Time Invariant)					
Production (pounds/acre)	1037	518	750	1000	825
Canopy Cover (percent)	30	17	22	29	25
Average Fall Height (feet)	1.5	1.5	1.5	1.5	1
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-10. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Nuff Soil in the Live Fire Area Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	350	350	350	350	350
K Factor Values					
Estimated K	0.17	0.17	0.17	0.17	0.17
Rock Cover (percent)	48	48	48	48	48
Hydrologic Group	C	C	C	C	C
Texture	Silty clay loam	Silty clay loam	Silty clay loam	Silty clay loam	Silty clay loam
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	4	4	4	4	4
Segment Length (feet)	55	55	55	55	55
C Factor Values (Time Invariant)					
Production (pounds/acre)	2075	1035	1035	1035	1656
Canopy Cover (percent)	55	30	30	30	45
Average Fall Height (feet)	2	1.5	1.5	1.5	1.5
Roughness	1	1	1	1	1
Percent Ground Cover	18	8	8	8	18
Mechanical Disturbance?	No	No	No	No	No

Table B-11. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Bastsil Soil in the North Fort Hood Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	332	332	332	332	332
K Factor Values					
Estimated K	0.24	0.24	0.24	0.24	0.24
Rock Cover (percent)	0	0	0	0	0
Hydrologic Group	B	B	B	B	B
Texture	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	2	2	2	2	2
Segment Length (feet)	91	91	91	91	91
C Factor Values (Time Invariant)					
Production (pounds/acre)	1714	827	827	1000	219
Canopy Cover (percent)	46	25	25	29	10
Average Fall Height (feet)	2	1.5	1.5	1.5	1
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-12. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Topsey Soil in the North Fort Hood Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	350	350	350	350	350
K Factor Values					
Estimated K	0.32	0.32	0.32	0.32	0.32
Rock Cover (percent)	0	0	0	0	0
Hydrologic Group	C	C	C	C	C
Texture	Clay Loam	Clay Loam	Clay Loam	Clay Loam	Clay Loam
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	5.2	5.2	5.2	5.2	5.2
Segment Length (feet)	48	48	48	48	48
C Factor Values (Time Invariant)					
Production (pounds/acre)	1116	558	750	1000	1000
Canopy Cover (percent)	31	15	22	29	29
Average Fall Height (feet)	1.5	1	1.5	1.5	1.5
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-13. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Bosque Soil in the North Fort Hood Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	251	251	251	251	251
K Factor Values					
Estimated K	0.28	0.28	0.28	0.28	0.28
Rock Cover (percent)	0	0	0	0	0
Hydrologic Group	B	B	B	B	B
Texture	Loam	Loam	Loam	Loam	Loam
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	0.5	0.5	0.5	0.5	0.5
Segment Length (feet)	30	30	30	30	30
C Factor Values (Time Invariant)					
Production (pounds/acre)	219	1000	1000	1000	1000
Canopy Cover (percent)	10	29	29	29	29
Average Fall Height (feet)	1	1.5	1.5	1.5	1.5
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-14. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Topsey Soil in the West Fort Hood – North Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	350	350	350	350	350
K Factor Values					
Estimated K	0.32	0.32	0.32	0.32	0.32
Rock Cover (percent)	0	0	0	0	0
Hydrologic Group	C	C	C	C	C
Texture	Clay Loam	Clay Loam	Clay Loam	Clay Loam	Clay Loam
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	6	6	6	6	6
Segment Length (feet)	46	46	46	46	46
C Factor Values (Time Invariant)					
Production (pounds/acre)	2108	1054	1054	1054	1054
Canopy Cover (percent)	56	30	30	30	30
Average Fall Height (feet)	2	1.5	1.5	1.5	1.5
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-15. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Krum Soil in the West Fort Hood – North Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	332	332	332	332	332
K Factor Values					
Estimated K	0.32	0.32	0.32	0.32	0.32
Rock Cover (percent)	0	0	0	0	0
Hydrologic Group	D	D	D	D	D
Texture	Silty clay	Silty clay	Silty clay	Silty clay	Silty clay
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	2	2	2	2	2
Segment Length (feet)	91	91	91	91	91
C Factor Values (Time Invariant)					
Production (pounds/acre)	1880	940	940	1000	940
Canopy Cover (percent)	50	27	27	29	27
Average Fall Height (feet)	1.5	1	1	1	1
Roughness	1	1	1	1	1
Percent Ground Cover	8	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-16. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Topsey Soil in the West Fort Hood –South Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	350	350	350	350	350
K Factor Values					
Estimated K	0.32	0.32	0.32	0.32	0.32
Rock Cover (percent)	0	0	0	0	0
Hydrologic Group	C	C	C	C	C
Texture	Clay Loam	Clay Loam	Clay Loam	Clay Loam	Clay Loam
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	6	6	6	6	6
Segment Length (feet)	46	46	46	46	46
C Factor Values (Time Invariant)					
Production (pounds/acre)	774	387	750	774	774
Canopy Cover (percent)	23	14	23	23	23
Average Fall Height (feet)	1	1	1	1	1
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-17. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Krum Soil in the West Fort Hood –South Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	332	332	332	332	332
K Factor Values					
Estimated K	0.32	0.32	0.32	0.32	0.32
Rock Cover (percent)	0	0	0	0	0
Hydrologic Group	D	D	D	D	D
Texture	Silty clay	Silty clay	Silty clay	Silty clay	Silty clay
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	2	2	2	2	2
Segment Length (feet)	91	91	91	91	91
C Factor Values (Time Invariant)					
Production (pounds/acre)	680	340	680	680	680
Canopy Cover (percent)	21	12	21	21	21
Average Fall Height (feet)	1	1	1	1	1
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-18. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Tarrant Soil in the West Fort Hood –South Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	350	350	350	350	350
K Factor Values					
Estimated K	0.10	0.10	0.10	0.10	0.10
Rock Cover (percent)	52	52	52	52	52
Hydrologic Group	D	D	D	D	D
Texture	Clay	Clay	Clay	Clay	Clay
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	11	11	11	11	11
Segment Length (feet)	34	34	34	34	34
C Factor Values (Time Invariant)					
Production (pounds/acre)	789	394	789	750	789
Canopy Cover (percent)	23	14	23	23	23
Average Fall Height (feet)	1	1	1	1	1
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-19. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Real Soil in the West Fort Hood –South Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	350	350	350	350	350
K Factor Values					
Estimated K	0.15	0.15	0.15	0.15	0.15
Rock Cover (percent)	5	5	5	5	5
Hydrologic Group	D	D	D	D	D
Texture	Clay loam	Clay loam	Clay loam	Clay loam	Clay loam
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	8.9	8.9	8.9	8.9	8.9
Segment Length (feet)	40	40	40	40	40
C Factor Values (Time Invariant)					
Production (pounds/acre)	581	290	581	581	581
Canopy Cover (percent)	19	11	19	19	19
Average Fall Height (feet)	1	1	1	1	1
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-20. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Topsey Soil in the Western Maneuver Area – North Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	350	350	350	350	350
K Factor Values					
Estimated K	0.32	0.32	0.32	0.32	0.32
Rock Cover (percent)	0	0	0	0	0
Hydrologic Group	C	C	C	C	C
Texture	Clay loam	Clay loam	Clay loam	Clay loam	Clay loam
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	6	6	6	6	6
Segment Length (feet)	46	46	46	46	46
C Factor Values (Time Invariant)					
Production (pounds/acre)	991	495	750	991	991
Canopy Cover (percent)	18	16	22	18	18
Average Fall Height (feet)	1	1	1	1	1
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-21. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Real Soil in the Western Maneuver Area – North Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	350	350	350	350	350
K Factor Values					
Estimated K	0.15	0.15	0.15	0.15	0.15
Rock Cover (percent)	5	5	5	5	5
Hydrologic Group	D	D	D	D	D
Texture	Clay loam	Clay loam	Clay loam	Clay loam	Clay loam
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	13	13	13	13	13
Segment Length (feet)	30	30	30	30	30
C Factor Values (Time Invariant)					
Production (pounds/acre)	565	282	565	565	565
Canopy Cover (percent)	18	11	18	18	18
Average Fall Height (feet)	1	1	1	1	1
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-22. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Ekrant Soil in the Western Maneuver Area – North Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	350	350	350	350	350
K Factor Values					
Estimated K	0.45	0.45	0.45	0.45	0.45
Rock Cover (percent)	3	3	3	3	3
Hydrologic Group	C	C	C	C	C
Texture	Silty Clay	Silty Clay	Silty Clay	Silty Clay	Silty Clay
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	2.8	2.8	2.8	2.8	2.8
Segment Length (feet)	63	63	63	63	63
C Factor Values (Time Invariant)					
Production (pounds/acre)	513	256	513	513	513
Canopy Cover (percent)	17	11	17	17	17
Average Fall Height (feet)	1	1	1	1	1
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-23. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Slidell Soil in the Western Maneuver Area – North Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	332	332	332	332	332
K Factor Values					
Estimated K	0.32	0.32	0.32	0.32	0.32
Rock Cover (percent)	0	0	0	0	0
Hydrologic Group	D	D	D	D	D
Texture	Clay	Clay	Clay	Clay	Clay
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	2	2	2	2	2
Segment Length (feet)	91	91	91	91	91
C Factor Values (Time Invariant)					
Production (pounds/acre)	1103	551	750	1000	1103
Canopy Cover (percent)	31	17	22	23	31
Average Fall Height (feet)	1.5	1	1	1.5	1.5
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-24. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Nuff Soil in the Western Maneuver Area – South Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	350	350	350	350	350
K Factor Values					
Estimated K	0.17	0.17	0.17	0.17	0.17
Rock Cover (percent)	48	48	48	48	48
Hydrologic Group	C	C	C	C	C
Texture	Silty clay loam	Silty clay loam	Silty clay loam	Silty clay loam	Silty clay loam
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	4	4	4	4	4
Segment Length (feet)	55	55	55	55	55
C Factor Values (Time Invariant)					
Production (pounds/acre)	601	300	601	601	601
Canopy Cover (percent)	19	12	19	19	19
Average Fall Height (feet)	1	1	1	1	1
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-25. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Doss Soil in the Western Maneuver Area – South Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	350	350	350	350	350
K Factor Values					
Estimated K	0.32	0.32	0.32	0.32	0.32
Rock Cover (percent)	5	5	5	5	5
Hydrologic Group	C	C	C	C	C
Texture	Silty clay	Silty clay	Silty clay	Silty clay	Silty clay
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	5	5	5	5	5
Segment Length (feet)	49	49	49	49	49
C Factor Values (Time Invariant)					
Production (pounds/acre)	504	252	504	504	504
Canopy Cover (percent)	17	11	17	17	17
Average Fall Height (feet)	1	1	1	1	1
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

Table B-26. Revised Universal Soil Loss Equation (1.6) Parameters Used to Determine Annual Soil Loss for the Real Soil in the Western Maneuver Area – South Management Unit

Parameter	*Alternative*				
	1 No Grazing	*2 Standard Method*	*3 Maintenance Threshold*	*4 Conservation Threshold*	*5 Combined (Preferred Alternative)*
R Factor Values					
R Factor	350	350	350	350	350
K Factor Values					
Estimated K	0.15	0.15	0.15	0.15	0.15
Rock Cover (percent)	5	5	5	5	5
Hydrologic Group	C	C	C	C	C
Texture	Clay Loam	Clay Loam	Clay Loam	Clay Loam	Clay Loam
LS Factor Values					
Segments	1	1	1	1	1
Land Use	Rangeland	Rangeland	Rangeland	Rangeland	Rangeland
Gradient (percent)	14	14	14	14	14
Segment Length (feet)	30	30	30	30	30
C Factor Values (Time Invariant)					
Production (pounds/acre)	487	243	487	487	487
Canopy Cover (percent)	16	10	16	16	16
Average Fall Height (feet)	1	1	1	1	1
Roughness	1	1	1	1	1
Percent Ground Cover	4	4	4	4	4
Mechanical Disturbance?	No	No	No	No	No

APPENDIX C

CONSULTATION LETTERS

TO BE UPDATED AS FORT HOOD COMPLETES CONSULTATION WITH THE AGENCIES CONCURRENT WITH THE PUBLIC REVIEW OF THIS DRAFT SEA

United States Department of the Interior

FISH AND WILDLIFE SERVICE
10711 Burnet Road, Suite 200
Austin, Texas 78758
(512) 490-0057
Fax: (512)490-0974

SEP 26 2000

Dennis Herbert
Chief, Natural Resources Management Branch
Fort Hood - Environmental Division
4612 Engineering Drive, Room 76
Fort Hood, Texas 76544-5028

Cons. # 2-15-93-F-003

Dear Mr. Herbert:

This letter outlines the U.S. Fish and Wildlife Service (Service)'s comments on the Draft Environmental Assessment for Grazing Outlease at Fort Hood, Texas dated June 2000. The Service appreciates the opportunity to comment on the Draft Environmental Assessment (EA), as the issue of cattle grazing on Fort Hood (Fort) is tied to the brown-headed cowbird parasitism rate on the Fort's population of endangered black-capped vireos and golden-cheeked warblers, for which the Service and the Fort have a standing Biological Opinion (BO).

General Comments

Whether or not the Fort chooses to continue any grazing lease, is solely the Fort's decision. So long as the terms of the current July 2000 BO are met, mainly in this case that the parasitism rate does not exceed 10% Fort-wide, the Service does not have a position opposing or advocating cattle grazing on the Fort. Only where there are impacts to endangered species, does the Service become involved in the grazing issue.

The Draft EA has no clearly identifiable Preferred Alternative. It is difficult to address specific concerns when it is unknown what actions the Fort prefers. While Alternative 2 (Restrictive Grazing) offers a mechanism to institute rotational grazing Fort-wide that could potentially benefit all aspects of the landscape from endangered species to soil erosion, the Service does not have a preference for one of the stated Alternatives over another just that it must be compliant with the July 2000 BO covering the Fort's activities.

Specific Comments

On page 3-9, lines 5-11 discuss the encroachment of Ashe juniper and other woody species into areas that decrease "forage production for livestock and wildlife", and that "Ranchers and land managers combat the encroachment of the woody vegetation and attempt to maximize forage production using prescribed burning and mechanical methods of brush removal." It should be clearly stated in this section that these "brush management" activities are done in coordination with the Natural Resources Management Branch in order to avoid impacting endangered species habitat; black-capped vireo habitat in particular.

On page 3-11, lines 28-29 state "During the period 1997-2000, under an agreement with the NRCS, Fort Hood resumed mechanical clearing of juniper in old-field and other areas unlikely to be occupied by golden-cheeked warblers." It should be specified how these "other areas" were determined unlikely to be used by golden-cheeked warblers. Did they not have the right habitat components or were they surveyed for three years (according to Service protocol) to determine that warblers were absent?

On page 3-14, line 24, "brush removal within 100 **miles** (**32.8** feet) of endangered species habitat" should read "within 100 **meters** (**328.0** feet)".

On page 3-16, lines 28-29 discuss the need to actively manage black-capped vireo habitat because "it is no longer used after approximately 20-30 years after disturbance." It has been the Service's experience that vireo habitat grows out of the preferred stage (at least in the eastern portions of its range), long before 20-30 years have passed. In the 20-30 year time-frame identified, some vireo habitat has the potential to become warbler habitat. This figure should be revised.

Page 3-18, lines 19-27, discuss the formal consultation between the Fort and the Service. References are made to an amended Biological Opinion issued in 1999, this should be changed to "the Biological Opinion in July 2000". In addition, this section talks about the Fort's development of an ESMP. It should be clarified that the ESMP has not yet been finalized and that the July 2000 BO states that the ESMP must be finalized with 90 days of the BO's signing (July 26, 2000) or the Fort must reinitiate consultation with the Service.

Page 3-27, lines 21-22 state "*EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations requires that Fort Bliss make achieving environmental justice part of its mission...*"; shouldn't the reference be for Fort Hood?

Page 4-2, lines 7-9 discuss the potential impacts to Environmental Resource Planning as a result of Alternative 1, the No Action /No Renewal of Lease Alternative. It should be stated in this section that one of the potential benefits to this Alternative would be that without cattle there would be lower numbers of brown-headed cowbirds, and a potential to have a natural lower parasitism rate.

Page 4-8, lines 17-21 reference the July 2000 BO stating that "the USFWS has concurred that the impacts would be compensated for by removing cattle from the core habitats in the Eastern Maneuver Area and other terms and conditions are met." The BO does not state that cattle should be removed from the Eastern Maneuver Area.

Page 4-10, lines 7-12 have the same erroneous reference as stated above in Comment # 9.

Page 9-7, the reference "USFWS. 2000. Draft Biological Opinion between Fort Hood and the U.S. Fish and Wildlife Service." should be changed to "USFWS. 2000. Letter from U.S. Fish and Wildlife Service to General LaPorte; Biological Opinion for Fort Hood."

If you have any questions regarding these comments, please contact Krishna Costello at (512) 490-0057, extension 223.

Sincerely,

William Seawell
for

David C. Frederick
Supervisor

October 24, 2000

Dennis Herbert
Chief, Natural Resources Management Branch, DPW
Fort Hood - Environmental Division
4612 Engineering Drive, Room 76
Fort Hood, Texas 76544-5028

Dear Mr. Herbert:

This is to provide you with comments on the "Draft Environmental Assessment for Grazing Outlease at Fort Hood, Texas, June 2000". The Department has just requested this document from John Cornelius. Mr. Cornelius has been quite helpful in explaining the purpose and providing the materials. An opportunity to assist in the development of the preferred option is greatly appreciated. Please be advised this document had not been received through any normal routing process from DPW at Fort Hood. Staff would have preferred greater coordination in the development and timely review of such an important document. As the state wildlife agency and signatory and active participant in a Memorandum of Understanding on endangered species and grazing activities at Fort Hood, the Department requests to be consulted on potential changes in these activities.

Fort Hood is a good example that grazing can be compatible with ecosystem management. Further it has convincingly proved that grazing and endangered species can coexist under proper management. The partnership between Fort Hood and Central Texas Cattlemen's Association has led to a national model on endangered species approaches. The trapping efforts on Fort Hood have not only been successfully transferred to private lands surrounding the Fort, but also to private lands in 30 central Texas counties. Fort Hood should take pride in serving as a catalyst and partner in this effort with Central Texas Cattlemen's Association through the MOU with US Fish and Wildlife Service and this Department.

Staff note that without grazing it would be difficult to control cowbirds and this is the case now on parts of Fort Hood presently without grazing. Data collected at Fort Hood and other areas demonstrate that cowbirds travel great distances, and those brown-headed cowbirds leaving adjacent private lands would clearly be expected to continue to negatively affect songbird production and populations on the base.

The Department recommends Fort Hood select a Preferred Alternative of rotational grazing as provided in a recommendation developed by USDA Natural Resources Conservation Service and coordinated with staff at Texas

Parks and Wildlife, alternative 5. Linda Campbell of our staff assisted in the development and review of this plan and the Department considers this the best alternative to address endangered species, vegetative diversity and erosion issues, particularly when training deferment is coordinated with cattle deferment. This alternative can be ably applied without fencing under livestock management techniques relying primarily on water and feed distribution.
We have all gained a great deal through the grazing and endangered species management issues at Fort Hood, and the Department would consider the option of eliminating grazing in the Grazing Outlease counterproductive to endangered species or other songbird management and research on the Fort, as well as endangered species management and outreach on private Texas lands.

Thank you for the opportunity to comment. In the future, please provide this Department with information throughout the process so we can better assist Fort Hood staff in the development of alternatives and more complete comment.

Sincerely,

Gary Graham
Director, Wildlife Division

Cc: David Frederick, US Fish and Wildlife Service
Coby Shorter, Office of the Governor

TEXAS HISTORICAL COMMISSION
The State Agency for Historic Preservation

GEORGE W. BUSH, GOVERNOR
JOHN L. NAU, III, CHAIRMAN
F. LAWERENCE OAKS, EXECUTIVE DIRECTOR

July 14, 2000

David C. Wrbas
Deputy Director for Environmental Programs
III Corps and Fort Hood
ATTN: AFZF-PW-ENV
Fort Hood, Texas 76544-5057

Re: Project Review under Section 106 of the National Historic Preservation Act of 1966; Preparation of Environmental Assessment for Grazing Out-Lease

Dear Mr. Wrbas:

Thank you for the opportunity to review the project description referenced above. This letter serves as comment on the undertaking from the State Historic Preservation Officer, the Executive Director of the Texas Historical Commission. The review staff, led by Ed Baker, has completed its review.

This office usually considers rangeland grazing alone to have no effect on historic properties. Exceptions might include the grazing of already overgrazed areas under alternative 3 and improvements involving heavy equipment or the removal or addition of farm structures under any alternative. Removal of animals from overgrazed areas under alternative 1 or 2 would likely mitigate, to a certain extent, adverse effects to historic properties from erosion.

Thank you for your cooperation in this federal review process, and for your efforts to preserve the irreplaceable heritage of Texas. **If you have any questions concerning our review or if we can be of further assistance, please contact Ed Baker at 512/463-5866.**

Sincerely,

for
F. Lawerence Oaks, State Historic Preservation Officer
FLO/elb

cc: Dr. Cheryl Huckerby, Ft. Hood cultural resources

P.O. BOX 12276 · AUSTIN, TX 78711-2276 · 512/463-6100 · FAX 512/475-4872 · TDD 1-800/735-2989
www.thc.state.tx.us

DEPARTMENT OF THE ARMY
HEADQUARTERS III CORPS AND FORT HOOD
FORT HOOD, TEXAS 76544-5028

REPLY TO
ATTENTION OF

Environmental Division

June 28, 2000

Mr. Lawerence Oaks
State Historic Preservation Officer
Texas Historical Commission
P. O. Box 12276
Austin, Texas 78711-2276

RE: Project review under Section 106 of the National Historic Preservation Act of 1966; Notification of the Preparation of an Environmental Assessment for Grazing Out-Lease at Fort Hood, Texas

Dear Mr. Oaks:

Fort Hood has contracted Science Applications International Corporation (SAIC) to prepare an environmental assessment (EA) evaluating the potential environmental impacts of the livestock-grazing program at Fort Hood, Texas, in Bell and Coryell Counties. The environmental assessment will address the continuation of grazing at current levels, modified levels, and the discontinuation of grazing at the installation.

Development of the EA is promulgated by the upcoming termination date of the existing grazing lease: March 2001. Assessment of the program and its impacts on Fort Hood's resources is in accordance with the Council on Environmental Quality guidelines pursuant to the National Environmental Policy Act of 1969 as well as a response to the Department of the Army guidance on Reimbursable Agricultural/Grazing and Forestry Programs. This guidance states that such activities shall support mission operations, support conservation compliance, and execute natural resources stewardship.

As part of conservation compliance under which the National Historic Preservation (NHPA) is administered by the Army, Fort Hood requests your comments regarding grazing and its effects on cultural resources based on the statewide experience within your office. Please forward these comments within 30 days, or sooner, if possible, for our review and incorporation into the assessment process. Should you have any questions or wish additional information,

please don't hesitate to contact Dr. Cheryl L. Huckerby, Fort Hood Cultural Resource Manager at 253-287-1092.

Sincerely,

David C. Wrbas

David C. Wrbas
Deputy Director for
Environmental Programs

Enclosure
Description of Proposed Alternatives

CC:
Mr. Danny Rakestraw, SAIC, Las Vagas Nevada
CPT John Kluge, Office of the Staff Judge Advocate, III Corps, Fort Hood, Texas
Dr. Cheryl L. Huckerby, Cultural Resource Management, DPW-ENV

APPENDIX D

LIST OF ACRONYMS

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ACSIM	Assistant Chief of Staff for Installation Management
AQCR	Air Quality Control Region
AR	U.S. Army Regulation
ARS	Agricultural Research Service
AU(s)	Animal Unit(s)
AUM	Animal Unit Month
AWSS	Area Weapons Scoring System
BCWCID	Bell County Water Control Improvement District
BEA	U.S. Bureau of Economic Analysis
BRAC	Base Realignment and Closure
°C	Degrees Celsius
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cmd	Cubic Meters/Day
CTCA	Central Texas Cattleman's Association
DA	Department of the Army
DOPAA	Description of Proposed Action and Alternatives
DPTMS	Directorate of Plans, Training, Mobilization, and Security
EA	Environmental Assessment
EMO	Environmental Management Office
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESMP	Endangered Species Management Plan
°F	Degrees Fahrenheit
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
GIS	Geographic Information System
GWOT	Global War on Terrorism
ha	Hectare
HAAF	Hood Army Airfield
INRMP	Integrated Natural Resource Management Plan
ISD	Independent School District
kcf	Thousand Cubic Feet
km	Kilometers
mgd	Million Gallons per Day
MOU	Memorandum of Understanding
MSA	Metropolitan Statistical Area
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPS	National Park Service
NRCS	National Resource Conservation Service
NRHP	National Register of Historic Places
NRMB	Natural Resources Management Branch
OTC	Operation Testing Command
PCPI	Per Capita Personal Income
PL	Public Law
PM_{10}	Particulate Matter Less than 10 Microns in Diameter
POC	Point of Contact
RCRA	Resource Conservation and Recovery Act
RGAAF	Robert Gray Army Airfield
ROI	Region of Influence
RUSLE	Revised Universal Soil Loss Equation
SCS	Soil Conservation Service
SEA	Supplemental Environmental Analysis
SHPO	State Historic Preservation Office(r)
SSURGO	Soil Survey Geographic database
TCEQ	Texas Commission on Environmental Quality
TNRCC	Texas Natural Resources Conservation Commission
TPI	Total Personal Income
TPWD	Texas Parks and Wildlife Department
TXU	Texas Utilities Electric Company
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
USC	United States Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service